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TO "ELECTRICAL REVIEW" READERS.

Owing to the continued increase in the circulation of the ELECTRICAL REVIEW in recent months, an increase which has become accelerated since the signing of the Armistice, we cannot guarantee that casual copies will be available. The only way to make sure of securing a copy regularly as issued, is to place a definite order with a newsagent, or else to subscribe direct to the Publisher, ELECTRICAL REVIEW, 4, Ludgate Hill, London, E.C. 4.

ELECTRICAL ENGINEERING IN THE ARMY.

SOME time ago we took occasion to comment on the shortcomings of the military authorities at the Front in connection with the supply of electricity to our various consuming departments—such as hospitals, workshops, offices, &c.—which was usually effected by means of innumerable little petrol-electric sets dotted about, instead of properly designed central installations put down for the purpose of meeting all the local requirements. Such installations might have been of quite a temporary character, capable of being transported to any position where they were needed and quickly set in operation; but apparently every department had to shift for itself in this respect, and the only method of doing so known to them was that of setting up a miniature supply system for each one. There appears to be a decided gap in the organisation of the Royal Engineers and in their training at this point; they are not taught, like the French Engineers, industrial technology, and while, as we most gladly bear witness, they are unexcelled in the arts of military engineering proper, they have not appreciated the fact that there is now no line of demarcation between military and civil engineering—the whole is one and indivisible, and until they master the principles of electrotechnology on modern lines, they cannot claim to have completed their training.

As a matter of fact, electrical engineering is, or ought to be, a very important branch of training for military purposes; for want of an adequate knowledge of this subject, there has been waste and loss on our side that must, in the aggregate, have run into millions of money, and must have greatly diminished the efficiency of our fighting forces, with the inevitable result of inefficiency in war—the loss of many precious lives.

We mentioned, in the earlier stages of the conflict, that the part played by electricity in the war appeared to be very circumscribed—confined, apparently, to telegraphy and telephony, local lighting, and searchlights—and that was, in fact, the case *on our side of the lines;* but what about the uses to which it was put by the enemy? Now that we have been able to inspect his handiwork, we find that he attached the greatest importance to the use of electricity for lighting and power, and that his work was marked by a very high degree of technical skill and able administration. No haphazard methods were allowed, and it was not left to each unit to devise its own little supply system; on the contrary, the work was carried out methodically and thoroughly, on economical lines, and with great rapidity when an advance was made. But the most striking and significant feature of the work is the fact that the supply was transmitted over great distances from large generating stations, at high pressures; while we have not been able to obtain particulars of the system in detail, we understand that literally thousands of miles of high-

pressure overhead lines were installed by the Huns for the supply of all requirements for lighting and power. The three-phase system was employed, and the transformer sub-stations were established in farms, dug-outs, and other places where their presence was not likely to be suspected. Apparently the electrical staff worked independently of any other unit, and carried out its work on practically permanent and up-to-date methods; and so complete was the system and ample the supply of electricity, that even civilians in the occupied districts were allowed to share in its benefits.

So far as we are able to ascertain, the use of overhead transmission and distribution on our part of the Front was a negligible quantity, though our French Allies adopted it freely and systematically. Moreover, we have heard that even when our lines were advanced in the wake of the departing Huns, no use was made of their electrical system; incredible as it may appear, we gather that the same old "system"—save the mark!—of dumping down a little petrol-electric set wherever a few lights were wanted was still practised, although the elaborate enemy installations were practically intact and crying out to be used! Sad tales have come to our ears of valuable electrical apparatus—including large generators and transformers, probably looted from French or Belgian undertakings—left rotting in the rain, without even a waterproof cover over them, owing to the inability of our military authorities to appreciate the value of the goods; and of stores of smaller electrical apparatus abandoned to the ravages of the civilian population, who, with a livelier intelligence, did not let slip the opportunity. Such incidents, while they horrify the civilian engineer, bear out our contention that in future electrotechnology in the broadest sense ought to form an essential part of the training of a Royal Engineer officer.

According to our information, the electrical work of the Huns in the regions which they have now evacuated was so thoroughly well done, and so admirably thought out, that it would constitute a valuable object-lesson to our own electrical engineers, and it would be well worth while for a party of the latter to visit the districts in question and make a careful investigation of the methods and apparatus which have been so efficiently employed by our enemies. We submit the suggestion to the Council of the I.E.E., with the warning that the opportunity should be taken while it serves.

Electric Supply—Why National?

The Board of Trade Electric Power Supply Committee's Report has resulted, since it was first published, in a plentiful crop of criticisms, technical, commercial, social, and political. The discussional potentialities of such a report are, of course, unlimited. We do not, however, propose to exploit any further fields of detailed criticism at the moment, but merely to draw attention to the one broad principle which constitutes the *raison d'être*, as it were, of the scheme recommended in the report, and which will, perhaps, tend to become obscured under the mass of indiscriminate controversy. The scheme proposed is a comprehensive one, of a "National" character, and if it cannot be carried out by private enterprise, the project is to be financed out of the public exchequer. As such a proposal involves a serious charge on the country, it is important to keep in mind the justifying principle upon which alone the Committee puts forward the scheme—namely, that it is of National importance that there should be available a supply of cheap power adequate for the expansion of existing industries and for the encouragement of industries altogether new. The "National importance" of the scheme is *limited* to its industrial aspect. The text of the report in this respect runs as follows:—

> That when British industry is subjected to the test of keen international competition after the war, its success will depend upon the adoption of the most efficient methods and machinery, so as to reduce manufacturing costs as much as possible.
>
> That a highly important element in reducing manufacturing costs will be the general extension of the use of electric power supplied at the lowest possible price, and it is by largely increasing the amount of power used in industry that the average output per head, and, as a consequence, the wages of the worker, can be raised.

Now when the Bill, which the Board of Trade will introduce to give effect to the recommendations of this Report, comes to be argued out in the Committee stage, it is of the utmost importance that this governing and limiting principle shall be kept prominently in the foreground. Almost everyone agrees with the soundness of the governing principle here enunciated. It is a truism to insist that the future of the country is bound up with its commercial development and prosperity in the few years immediately ahead of us. This is the end to be achieved; and, as the Board of Trade Committee's Report clearly shows, the object of the scheme there put forward (in fact, the only justification advanced for putting forward a scheme at all) is this alone. When, therefore, the project in detail is laid open in the Bill, it must be checked point by point by this principle, and whatever alternative suggestions may be evolved during the progress of the Bill, they must be judged solely by their adequacy to attain this end. State trading, State financing, State control are, *per se*, none of them principles under this Report, but merely possible means towards an end—namely, industrial development. Further, the principle logically provides a limitation to the proper extent of the scheme.

We have emphasised the necessity of keeping this principle clearly in mind, in view particularly of the way in which the daily Press has raised a cry of cheap electricity for everybody, which will tend, perhaps, to become increasingly suggested as the real purpose of the scheme. The cry is an echo from the London County Council scheme of 1914, when particularly inviting prospects were held out to the London householder. It is interesting to note that, in justification of the scheme then prepared for London, the Council's consulting engineers (Messrs. Merz and McLellan) put forward mainly the "domestic" argument, mentioning the "industrial" aspect as incidental.

The Coal Conservation Sub-Committee reported somewhat expansively on the domestic side, but the Board of Trade Committee wisely included domestic uses only as of secondary and subordinate consideration. It cannot, therefore, too clearly be borne in mind that the Board of Trade does not propose any State finance or support to the end that private householders should have cheap electric cooking, heating, vacuum cleaning, and so forth, none of which, however desirable, can be claimed as of national consequence in the same sense as cheap and universal electric power. In fact, if the Board of Trade had committed itself to the proposition that it was so necessary that the country should use electric cooking and electric heating that even State aid should be invoked for that purpose, it would have landed itself in the dilemma that it was catering either for the luxury of the few or for the necessities of everyone—the latter case leading to the inference that the Government considered it of pressing national importance that every gas stove and gas cooker should be scrapped at the earliest possible moment! This, however, was not the intention of the Board, which has done well in basing its Report on a clear and unequivocal principle.

That the supply of electricity for domestic uses will be greatly cheapened and extended, and that important economies of fuel will result, together with other well-known benefits, goes without saying; but these are incidental advantages, and should not be mistaken for the main purpose of the scheme.

THE GERMAN ECONOMIC SITUATION AND TENDENCIES IN BRITAIN.

GERMANY, whether repentant or unrepentant for the misdeeds of those who caused and waged the world war, is to-day paying part of the penalty that Prussian militarism has imposed upon it. There is now no faltering in the relentless tread of Nemesis. Our own newspapers tell us from day to day of the struggles that are taking place in Berlin and other places in which the "Government" and the extremists respectively strive for supremacy. The former appears to stand for orderly revolution, while the latter seek to feed the fires of Bolshevism. While it is impossible for anybody to forecast what will be the ultimate issue of things in Russia, or what form the new order will take either there or in Germany, it is certain that industrial revolution is in full swing in both countries, the consequences of which will be felt there, and, indeed, practically everywhere for long years to come. The developments that have occurred in this country in the course of the last few months would in pre-war days have been regarded as a revolution; but large and sweeping as they have been here, they have been effected without violence save to the ideas of men. It may be said that the reasons why our own changes have been brought about in comparative quiet are found in the fact that we have won the war, while Germany and Russia have both lost it; that in both those countries the people have suffered years of serious privation; that the influence of Tsarism and Kaiserism has left the millions smarting under a sense of wrong imposed by authority; and that the prospective burden of the future is insufferably heavy. We must add to these an important factor, namely, that in England during the period of the war the lesson has been brought home in season and out of season, that if industry is to continue to be carried on for private profit the employés must labour under more humane or civilised conditions and receive better wages. The transition period has brought many problems up for settlement already, and we cannot expect to pass through the inevitable period of disorganisation and unemployment and the progress of demobilisation without further marked changes occurring. If we believe that the German people will before long come to see that their safety, whatever their burden of liabilities, lies in a sane policy of industrial security, we certainly are more entitled to hold that the sound common sense of the British race will guide us all, whether as employers and employed, or as classes and masses, in the right direction. There is, happily, little room for doubt that, given harmonious relations, there is plenty of work awaiting us in this country as soon as we can reverse the machinery of organisation from war to Peace. But, as Mr. Wardle, M.P., remarked last week, what we need, in order to secure content and prosperity, is industrial unity; "industrial Peace" he described as merely negative. "Industrial unity" is a constructive and active policy which means not mere quietness, but the making in quietness of progress toward a state of things in which industry is made to yield a proper return to all the interests concerned with it.

We have been greatly interested in the views expressed in many of the German newspapers during the past month or two concerning some of the movements that are proceeding in German industry, and we think they might be considered with advantage by those who are responsible for influencing or leading the thought of those connected with similar matters in this country. The demands of the workers in all countries are very much alike—in some the violent seek to take the kingdom by force, and the battle sways sometimes uncertainly. We have in our own midst those who openly avow that peace along the lines of the Whitley Report is not what they desire; unity between Capital and Labour is the one thing that they do not seek; they wish to abolish the masters and the capitalists once and for all, and if we promote friendliness at this juncture the realisation of their hopes will be deferred, perhaps, never to recur under such favourable circumstances. We do not believe that this element is one of great strength numerically, but the peculiar thing about it is that some of them are described as clever and cultured, with which combination there also appears a willingness to be as ruthless as any Prussian militarist, if by such means their end can be attained. We believe that history, if it deigns to take note of their efforts, will condemn them as being equally short-sighted, and altogether wrong in their calculations.

The events that have been taking place in Germany may be described briefly by our giving a summary of a few outstanding matters. In December last the Thuringian Industrial Union called for the restoration of economic security and stability. It referred to the extraordinary rise in the cost of production that must follow on the satisfaction of the demands then made by workers in all fields of employment. The home demand for all kinds of goods was reasonably to be expected to fall, owing to the rise in prices, and the industries would be unable to compete in the foreign markets with countries which did not have to cope with such increases in wages. The Union pointed out that the suggested control of industry would only make matters still worse, owing to the lack of technical knowledge and commercial experience on the part of the workers. Some leaders in Germany are not slow to point out, as leaders of Labour and social reform here have foreseen also, that nationalisation of industry can only be gradual, and requires decades to be carried out. Mr. Arthur Henderson himself, when pinned down to the expression, "control of industry," showed that his use of it was only meant to be immediately, or at first, applicable, in the main, to public services.

We read that Geheimkommerzienrat Ventzky, of Graudenz, is said to have handed over the control of his business to his employés in return for an interest of 3 per cent. being paid on his capital. Herr Walther Rathenau, of the A.E.G., whose views were printed in our last issue, is reported to have handed over his private furtune of a million pounds to the State. These, and other similar occurrences, are, no doubt, concessions to the demands of the mass of workers who are determined to have better wages, and who look chiefly to the profits of the capitalists to yield them without working out the simple sum which would show the smallness of the share of the individual worker. But why do they demand higher wages just now? Chiefly to meet the increase in the cost of living imposed upon them by reason of the war which their leaders have brought upon them. The one demand due to necessity, made while they are in anger with authority, leads them to make other demands which they consider will mend matters permanently, But what are the hard facts of the situation right up against which they are now brought? Germany has to pay the cost of the war. How is it to be done?

One proposal under discussion is State Bankruptcy. The cancellation of loans would, "at a stroke," free Germany of one-half of her liabilities; but it is said (*Weltwirtschaft Zeitung*, December 13th) that such a step would be a monstrous injustice to citizens who have helped to finance the war. One Ferdinand Rinkel, of Cologne (in *Kölnische Zeitung*, December 7th) estimates that the national wealth of Germany is now less than half what it was before the war. "The State obligations exceed the whole national wealth, and it needs no gift of prophecy to foretell an approaching catastrophe." He calls for appropriate economic measures to be clearly stated, in order to dispel prevailing uncertainty, or there will be disaster. He hears out of the welter of economic clamour three phrases:—"Death to capital—eight hours' working day—higher wages." He finds fault with the authorities who are in power because they do not make the situation of impending national bankruptcy clear to the workers, and persuade them to accept lower wages, instead of inciting them to further demands. Industrial and other undertakings will be unable to pay heavy taxation, and the State will, therefore, lose part of its revenue. Even threats alone to burden capital with heavy imposts depreciate the value of shares, &c., to such an extent that "the State will be

unable to impose heavy duties on capital, for the simple reason that only part of it is left." He instances a manufacturer who six months ago had made a million marks by the war, which he invested in Stock Exchange securities, with the result that he now only possesses, at most, a property worth 250,000 marks. One writer advances, as a measure for increasing the national revenue, the imposition of high taxes upon the goods to be sold by producers. This would mean that the cost of production would be increased by the entire sum of the taxes, and the selling price would be raised accordingly. And where would the consumer be then, who already finds the cost of living so great that he makes heavy demands? This same writer advocates improved production as the best method of increasing the efficiency of the economic system. He would eliminate all concerns working at a loss—possibly, in the natural course of things, may we suggest, they would eliminate themselves—he would reduce the cost of transport to a minimum (still paying transport workers high wages and running shorter hours ?) and would obtain the highest possible yield with the lowest possible outlay "by concentrating and systematising business concerns." "In this way increased revenue and decreased revenue will be available for the payment of interest, *so far as they were not required for increased wages for labour*." He is unable to determine whether this increased economy of working is to be obtained from nationalisation of the means of production or by means of State-controlled syndicates of private business concerns."

We notice that a certain Prof. Franz Eulenburg, of Aix-la-Chapelle, favours a levy on capital, yet he says that "Germany's position and credit abroad would be endangered for all time if she failed to recognise the validity of her war loans." He says that popular opinion is decidedly in favour of the burden of debt being partly redeemed by a levy on capital, instead of shifting that burden on to shoulders of future generations, especially as vast accumulations of capital have resulted from the profits made in the war. As we have several times suggested German manufacturers may yet wish that they had been required to pay Excess Profits duties during the war.

One George Bernhard, however, has been expressing a totally different view from that held by Eulenburg, holding that a levy on capital to any extent, even if it only affected reserve funds, would lower the capacity of production of all undertakings carried on in the form of joint-stock companies, and would have a restrictive effect on the entire economic system. If a very considerable part of the capital of the business man and manufacturer is taken away from its owner "the growth of capital is checked, and with it the possibility of any extension of industry and trade, and, at the same time, a heavy blow is struck at the producing capacity of the nation." "The provision of new machinery, and especially the extended application of new processes, and also the speedy changes necessary in the case of new costly methods of production, demand unlimited possibilities in the way of providing the requisite fund."

So much for taxation questions in their relation to industry. Returning to the wage question, it is protested that inflated wages are being paid in German shipyards by order of the Government. The Government is itself paying a proportion of what are described in the German Press as "ridiculously high wages," and it is deplored that ships cannot be built as cheaply as in other countries under such circumstances. Another criticism of the wage situation is that there is hardly a perceptible difference between the wages paid to skilled and unskilled workers. This may mean that a skill which hardly differentiates between incapacity and efficiency will crowd workers into employments which require little knowledge, and cause a shortage of labour for work which demands special qualifications, and, consequently, is used to command higher remuneration.

But notwithstanding all that international statesmen and others are saying about the increased wages and the better conditions that must henceforth prevail—with which we, and, indeed, everybody, must agree up to a certain point—we believe it to be an economic inevitability that excessive wages must fall and abnormally short working hours must eventually be lengthened, unless something in the form of universal international understanding is arrived at so that the same drawbacks confront all competing peoples. The man who asks for, and receives, higher wages is adding to the cost of the necessaries of life for himself if all men are out for the same advances. There can be little satisfaction in handling £5 a week in place of 50s. if you have to spend double. This seems to be—with, of course, exceptions in certain trades—what must certainly happen unless there is a universal will to work harder, with the improved opportunity of doing so with less fatigue that more efficient machinery and methods will present. Of course, we all expect, after the experience of war time, that shorter working hours will improve the individual efficiency if the change is adopted in the right spirit, and if the movement is not carried too far; but, unfortunately, as we have seen in the recent 47-hour disturbances, there is a disposition to raise new obstacles at almost every turn, and to gain some new point at the employer's—or may we say industry's?—expense. There is a will to agitate for better conditions and higher wages without calmly looking to the end which lies beyond it all. We seem to lack either the ability or the willingness to see beyond the ends of our noses. It seems as though men are indifferent as to where it will all lead them ultimately, so long as in the present they can secure what they want. We feel that whatever course events take, violently revolutionary or otherwise, the present tendency is only temporary, and that abnormal or unreasonable advantage secured by any mass of workers out of present peculiar conditions, will in a few years disappear. But we are all walking in the dark just now, feeling our way as we go, stumbling and then recovering; but there are at work economic forces which will decide whether we shall fail to recover after one of our stumbles. Many statements are made by our public advisers, which are acceptable because they reflect our desire to make things better for the millions of workers whose lives have been very drab and uninteresting in the past. We all yearn for a general improvement, and sometimes we are told that no industry should be allowed to continue unless it can yield to those employed in it a living wage and humane conditions. Perhaps in actual working it might appear that the closing down of a works and the sacrifice of capital would mean the unemployment of thousands of workers. Never mind that say our advisers—such a business should not be allowed to continue. We used to say that half a loaf was better than no bread—not so now. We repeat that we are as anxious as anybody to see wages higher and hours shorter if these things can be secured without killing the goose that lays the golden eggs. As Mr. Hichens recently suggested, let us not be "off and away" before we have thought whence we are going. Has the Government plans for securing permanent well-being of the nation as a whole before it steps in and decides that this, that, and the other change must be introduced on a specified date? And have the Trade Unions, which ought to have the well-being of the industrial life of the nation so largely resting upon them, given a sufficient thought to permanence and stability of industry, and to the inevitability of the effect of high wages on the cost of living? A moderation of their own demands might conceivably make for their own ultimate advantage. Have they also thought that the return on investments, upon which tens of thousands of comparatively poor people depend is reduced by half, as in the case of the value of wages?

We are undoubtedly only at the beginning of our discussions of the problems of industry. They will become more and more general in the coming months, and more and more acute as millions of men return and want to find industry prosperous enough to absorb them at the satisfactory wages that non-fighters have been receiving. We shall require to develop our trade to the utmost that lies within our power; we shall require to operate as efficiently as possible—capital, organisation, and labour; but we shall have to act in co-operation—in "Industrial Unity," or much that we have will be lost, and some things that we aim at will never be achieved.

Germany has her own problems to settle. We have ours. Perhaps we shall be assisted in our own deliberations by studying such enemy experiences and opinions as we have endeavoured to set forth above.

There are two German pre-war sayings that occur to us as we write: "Hope is the poor man's bread," and "Laughter is the poor man's plaster covering up each dire disaster." But "hope" and "laughter" will not meet the case of any of the peoples to-day. Koth, the German Chief of Demobilisation, recently said, "Hard work is the only salvation of the German people." But it is not only true in the case of Germany. Every Briton has got to put his shoulder to the wheel, and if he determines to push it for so many fewer hours a week, and receive so many shillings a day more, he must push all the harder.

BRITISH ELECTRICAL TRADE IN CHINA.

I.—THE OPPORTUNITIES.

BY PROF. MIDDLETON SMITH, M.Sc., M.I.Mech.E., Hong-Kong.

THE alert Editors of the ELECTRICAL REVIEW have evidently been thinking about the markets of the Far East, at the beginning of the fifth year of the war, despite the anxieties and difficulties of the people in Great Britain in general, and of those responsible for trade publications in particular.* They have been wisely anticipating and preparing for the period of reconstruction. "England expects" in these times of her engineers and manufacturers not only that "this day" they will do their duty, but that before the day of demand they will prepare for the duty demanded of them, if it comes next year or even the year after. In all of our engineering work there is the period of planning; the drawing office stage of the business. We have to think things out, to collect all of the data possible, to make up our minds as to the best methods to be used in translating the designs into practical work, before the ideas are crystalised into the lines and instructions which go from the drawing office. It is in the hope of supplying some suggestions to electrical manufacturers and other readers of this journal that the invitation of the enterprising Editors is accepted. As the Americans say, they want "to make wise" their readers concerning "our" chances in China, and they ask for information that will help the trade in Great Britain. That is the object of this contribution.

For more than six years the writer has been working with the Chinese for most of the year, travelling about the Far East in the long vacations, writing to all who are connected with engineering work out here, meeting some of the most prominent Britons and Chinese, making notes on this great problem of trade in China. The subject of British trade prospects in the Far East has been a matter very much in mind. Seeds were sown many years ago in Birmingham by that remarkable man, Mr. Joseph Chamberlain, and the Far East has developed them. In a never-to-be-forgotten conversation before the days of the Tariff Reform crusade, Mr. Chamberlain talked of the engineering trades, the future of the Empire, and overseas markets to a young demonstrator in the University which he had created. He was practical, if a visionary. Like an architect who plans a structure he saw the building, even the details of the materials for the building long before there was anything more tangible than thoughts. He was, beyond all else, an organiser. He realised that each year would make engineering products more and more important as articles of commerce.

"*Does it Pay?*"—"What do they know of England," cried Kipling, "who only England know?" Yes, if you want to appreciate the land of Magna Charta, the land of Newton, Watt, Faraday, and those others who have done things which will leave a mark on the pages of history for all time, leave your England and travel round the world. You will not forget those of your countrymen mentioned above; but you will learn about others. You will find the trace of the British engineer and administrator from Vladivostock to Singapore from Shanghai to Cairo. You will not gain a cubit in stature, but you will hold yourself more erect; you will find a new fibre stiffening your thoughts; you will, if you are connected with engineering work, recognise that you are in a profession or trade which is "cleaning up" the Universe, which is doing something great. You will see the striking contrast between the way of the Anglo-Saxon and that of the men of other nations—especially the Orientals. You will become so proud and confident of the men of your own race that you will cease to show any traces of aggressive pride about them. You will accept it as you accept other works of Nature—as something almost inevitable. But it exists.

If you visit China you will, indeed, realise what has been done, and the possibilities of what can be done. Just as there is a new Europe, so is there a new China. Nothing is more striking than the complete change in outlook of the whole nation concerning machinery and modern industry. The attitude of the Chinese to-day when compared to that of 20 or even 10 years ago is astonishing.

They have asked about all of this modern apparatus the question that the keenest traders of the world would naturally ask. They said, "Does it pay?" and the answer has come from Japan, Hong-Kong, Shanghai, and even inland China. Always the answer has been, as the politicians say, "in the affirmative." In that mysterious manner of the East, of which we understand little, but which is as effective as a newspaper with a circulation of millions, the story that it does pay, the examples of how it did pay, have sped through China. The keen trader is, of course, naturally suspicious of being "let in," and on more than one occasion the Japanese drummer has let him in. Yet he is still keen, and he wants to make money. They talk about the almighty dollar in the United States. In China the dollar is super-almighty. And the Chinese of to-day are beginning to think that Western science manufactures and multiplies the super-almighty dollar. They are aanxious to find out how it is done.

British Assets.—There is nc doubt that the Chinese have a very great respect for the British nation. The history of the British in China is too long to discuss here, but the most influential Chinese do realise what the British have done, not only for China, but in the Straits Settlements, Hong-Kong, and Shanghai. "It is our honesty that keeps us going," said a shrewd British official to me, a few days ago; "the Oriential respects the Englishman because he gets justice and the square deal from him." It is also our energy that keeps our trade going.

Perhaps the most remarkable piece of administrative reform work ever carried out was that of the Chinese Maritime Customs. It was the work of Britons, Sir Robert Hart being chiefly responsible. Sir Edward Grey has proposed it as a pattern for the administration of backward countries. It has been recently copied for the organisation of the Salt Gabelle, in China, by Sir Richard Dane. These two Departments are the only two revenue-producing, or official sources of national income, free from corruption in China.

The first British Chamber of Commerce was founded in Canton about 80 years ago, and there are now many other similar institutions—about 20—in China. These are determined to help British trade.

The Chinese Consular Service of Great Britain has a splendid reputation for everything but business training. Its servants have been men of high character; some of them have been great sinologues. One of them, Sir Harry Parkes, was a Great Englishman, "a man of push and go," who did wonders for our interests in China 40 of 50 years ago. The Chinese, be it understood, respect our Consular Service for its honourable tradition and the scholarship of many of its members.

The British have always had most of the external trade of China in their hands. They have opened up the country to steam; they have introduced machinery; they initiated and carried out the steam shipping trade of the rivers and the coast. They have provided the largest bank in China. Actually a British bank determines each day for China the vital question of exchange—how many dollars in China go to the pound sterling; in the four years of 1913-17 that number fluctuated from about 9 up to 13; and three months ago it was down to 5½. Those figures give some idea of

* These articles were written just before the war ended.—EDS. E.R.

the importance of exchange as well as of British interests in China.

Beyond all else the most valuable asset of the British in China is their reputation for the square deal. "The Chinaman's word is his bond" was the boast of the old days when the British practically held a monopoly in trade in China. Hundreds of thousands of pounds' worth of business was carried on between British and Chinese traders, and never a bond, but the word of each. The times have changed, but the old reputation remains. There are British firms in China whose verbal word is accepted for millions of dollars, and whose paper is like that of the Bank of England in London.

The local share market in Hong-Kong reflects British prestige. This Colony is the headquarters of at least one hundred British companies trading out here, including "the Princely House" and "the Bank." The largest insurance company in the British Empire has its headquarters and its board of directors in Hong-Kong. Its shares were worth about £10, some 30 years ago—the local quotation to-day in Hong-Kong is more than $120; at the rate of exchange that is about £150. The Chinese rush to invest money in British companies, or in property in Hong-Kong, or in the treaty port Settlements, managed by the British. The most famous mining administration in China is managed by the British—its Chinese shareholders are delighted with their dividends. No other nation has such a wealth of experience with the trading Chinese as our own. The Chinese are demanding Western machinery and applied science; the British have valuable assets in China, as enumerated above. Will they supply the bulk of the machinery needed in China? The opportunities are magnificent. Yet there are difficulties. They will be discussed in the next article.

METHODS OF "EARTHING" THREE-PHASE SYSTEMS.

By C. L. BROWN, A.M.I.E.E., Lt. R.E.

It is now recognised as advisable to "earth" the neutrals in all but small systems, in which cases it is optional; the advantages being:—

The voltage between any phase and earth is reduced to 58 per cent. of the volts between phases.

A fault to earth on an unearthed system would be most certain to develop into a short circuit between two phases.

An earthed system lends itself more readily to protective gear, an earth or leakage being at once located.

On an earth occurring on one phase it must be immediately attended to, so avoiding delay, with possible serious trouble as a consequence.

Preferable where electric furnaces are on the system, where lengthy and heavy short circuits are liable to occur.

In many cases the neutral points of generators are earthed direct, but it is recommended that, where machines run in parallel, a neutral bus-bar be installed and earthed in place of each generator separately; the question of currents due to triple-frequency harmonics circulating between machines is of no great importance as far as this is concerned, and, if objection were raised on this account, small resistances could be placed between each generator neutral point and the neutral bus-bar. The methods of earthing are:—

1. Direct to buried earth-plate.
2. Through metallic or carbon resistance.
3. Through transformer.

The I.E.E. rule *re* size of earthing conductor for connecting between neutral bus-bar and earth, also between generators and neutral bus-bar, should be adhered to—*i.e.*, 1/14 S.W.G. wire, or equivalent sectional area in smaller wires, per 50 amperes working current; it is usual in large installations to use copper tape, say 1 in. × ⅛ in.

1. This simple method is well known, and consists of connecting the earth wire or tape from neutral bus-bar, or generator neutral, if the former is not provided, direct to the earth plate or cone; the former may be a copper plate up to 6 ft. square (for large plants, say, 120,000-KW. capacity), this plate being surrounded by coke and sunk about 6 ft. in damp ground; a perforated metal cone may be used as a substitute. In addition, it is strongly advisable to earth on to the circulating-water pipe system, thus providing a precautionary measure at small cost without disadvantage.

All copper earth wires or tapes should be zinc or lead-sheathed, and run in pipes for protection; here it would be well to point out that careful periodic examination of earth wires is necessary, and resistance tests may conveniently be carried out from time to time.

2. In this case the connection from the neutral bus-bar or generator is on to a metallic or carbon resistance, and through this resistance to the earth plate or cone and duplicate to water pipe, exactly as stated above; the carbon resistances are preferable, as they appear to withstand sudden

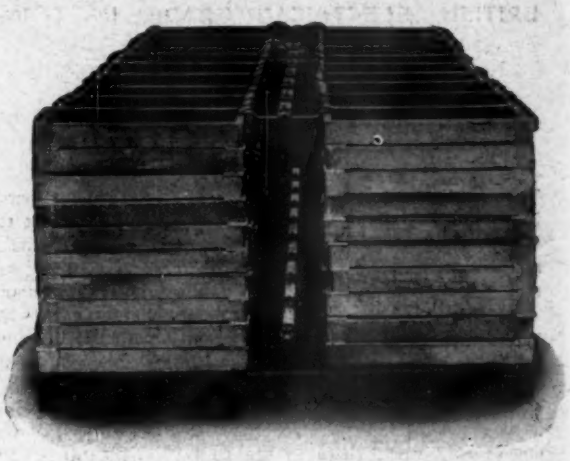

Fig. 1.—Carbon-Powder Type Resistance.

loads better; in any case, the resistances for large stations should be capable of dealing with heavy currents of short duration according to the capacity of the station and the nature of the loads. The carbon resistances may consist of units in series-parallel, and may be arranged so that it is a simple matter to add to them if necessary, say, when increasing the capacity of the station; when loads consisting of electric furnaces are added, it will sometimes be found necessary to amplify the earthing arrangements.

The resistance shown in fig. 1 is of the carbon-powder type; in this instance it is built up of 200 units, the total being of about 500 amperes' carrying capacity on

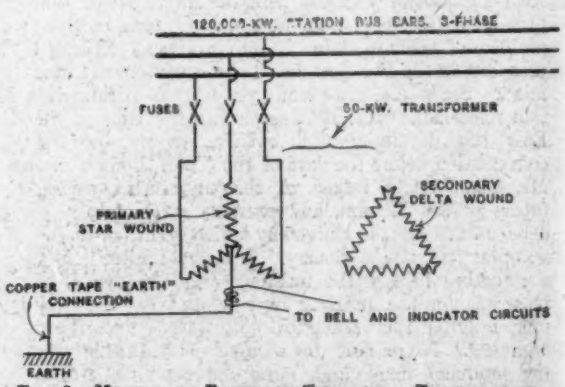

Fig. 2.—Method of Earthing Through a Transformer.

an 11,000-volt, 3,000-KW. system; the capacity of such resistances may be roughly found from the formula:—

Capacity in amperes
= KW. (of station) × 1,000 × $\sqrt{3}$ ÷ volts,
= 1,730 × KW. ÷ volts.

It must be remembered that as carbon possesses a negative temperature coefficient, the current will not rise above a value which is just sufficient to open the circuit-breaker, with a consequent minimum of shock on the system and a correspondingly less chance of heavy surging; with the

resistances having a positive temperature coefficient, their total resistance must naturally be less than in the case of carbon; more current must pass to ensure the circuit-breakers operating immediately, and before the resistance increases due to heating sufficiently to prevent the breakers working, the result being a prolonged overload and probable burn-out; therefore, where metallic resistances are installed, they should be designed so that the current to earth would be greater than in the carbon type, in spite of having to break a heavier current and a greater chance of surging. The careful setting of time lags on the breakers will assist in overcoming the difficulty.

3. The method of earthing through a transformer is quite in favour; fig. 2 is a diagram showing a typical arrangement. A 50-KW. capacity transformer of the bus-bar voltage is connected to the main bus-bars through fuses, the latter being advisable to guard against a burn-out, should a very heavy short not clear itself in time. The transformer primary is star wound, the secondary being delta or mesh wound on open circuit; the neutral point of the primary winding is connected to a substantial earth-plate, as pointed out in (1), also to water-pipes. In addition, a small coil may be fixed round a convenient part of the earth wire, which would become energised on an earth current or leakage of predetermined value passing, thus ringing a bell, which may be fixed in the engineer's office. This may be improved upon by fixing the coil wires to an instrument indicating the strength of the current to earth.

EXHIBITION OF BRITISH SCIENCE PRODUCTS AT MANCHESTER.

THE instructive exhibition held at King's College last summer,* the purpose of which was to indicate to the public, and more particularly to manufacturers, the great services British science rendered to British industry during the war, has very properly been transferred to Manchester, where for the past fortnight it has attracted a large and appreciative local public. The exhibition was organised by Mr. F. S. Spiers under the auspices of a local committee, presided over by Principal Garnett, and it was held in the College of Technology, three floors of which were utilised for the purpose. The exhibition was not an exact replica of that held in London, and while in some respects, notably chemical glassware and optical instruments, it fell short of the parent one, in other respects, dyes, textiles, and thermal apparatus may be instanced, the exhibits were both more numerous and more representative.

The electrical section illustrated principally the notable advances made in the production of magnetos, insulating materials, lamps, carbons, electric heating apparatus, and instruments—machinery had to be excluded. In all these cases we were largely, and in some instances entirely, dependent upon Germany, and the efforts made, under the stress of war conditions, by our manufacturers aided by our men of science to render this country, so far as possible, independent of foreign supplies will form an impressive chapter in the history of British industrial effort.

With regard to the individual exhibits, we need here only make brief mention of such as were not shown in London. The collection of magnetos and magneto parts, illustrating the whole complex process of magneto construction, was a remarkable one—quite the most complete that we remember having seen. In addition to the splendid and "live" collection shown by the British Ignition Apparatus Association, and contributed to individually by each of the ten firms constituting that Association, separate exhibits of great merit were shown by Messrs. Vickers, Ltd., Simms Motor Units, Ltd., and a local firm, the Runbaken Magneto Co., Ltd.

In carbons, a wide variety, made of high-grade carbon, was exhibited by the Morgan Crucible Co., Ltd. Besides the well-known Morganite brushes, these included magneto carbon for the distributors and slip-rings of aeroplane and automobile magnetos, battery carbon rods for pocket flashlamps (since 1914 this firm has produced a hundred million of these rods), carbons for electric welding arcs, and telephone carbons for transmitters and receivers. This firm also now makes electro-graphitic electrodes for use in electric furnaces. For many purposes these are preferable to—their life is longer than—the ordinary amorphous carbon electrodes. All of these accessories came from the Continent or from America before the war.

Most of the present types of electric heating elements were shown by the British Electric Transformer Co., Ltd., and the Edison-Swan Electric Co., Ltd. The former exhibit included the electric gun heaters for keeping lubricating oil from freezing in Vickers and Lewis guns when used on aeroplanes. Electric heating apparatus for medical and other purposes was shown by Messrs. E. M. Evans & Son, Ltd., of Manchester.

A splendid collection of scientific instruments, both for works and laboratory practice, was exhibited by Messrs. Chas. W. Cook, Ltd., of Manchester. The collection included the various electroscopes designed and used by Sir Ernest Rutherford for the accurate measurement of α, β, and γ rays, and a massive electromagnet, also used by Sir Ernest, with a capacity of 16,000 gauss. The workmanship and finish of this firm's apparatus is beyond praise. Pyrometers and electrical instruments were also shown by the Foster Instrument Co., Ltd., the Record Electrical Co., and the Cambridge Scientific Instrument Co., Ltd. The Cambridge firm exhibited, among other things, an electrical distance thermometer outfit for centralising and reading temperatures from any number of positions, and an aeroplane radiator thermometer for taking temperatures of cooling water. Mr. A. E. Moore, of the College of Technology, had on view his concentric standard dynamometer watt-meter for heavy currents, described in the ELECTRICAL REVIEW of June 8th, 1917.

The Fuller Accumulator, Cable & Carbon Works showed in connection with their batteries and lamps a charging rack for replenishing the accumulators of miners' lamps. The Wardle Engineering Co., Ltd., of Manchester, had on exhibit many types of reflectors designed to meet varying industrial requirements. In every case a polar curve recorded the characteristic distribution of light.

Messrs. W. T. Glover & Co., Ltd., among other examples exhibited a six-core "Diatrine" paper-insulated and lead-sheathed cable, suitable for an 11,000-volt circuit, provided with Glover's patent test sheath, by which injurious effects from outside and leakage from inside the cable are bound to be intercepted by the test-sheath conductor.

The exhibit which perhaps attracted most attention was the ingenious winding machine—used principally for the fine coils required in wireless work—shown in operation by the Igranic Electrical Co., Ltd. In this machine the fine insulating cotton yarn is interwoven between the layers of concentrically-wound wire, and the two are wound simultaneously. By an ingenious cam mechanism the yarn also builds up insulating end cheeks, so that the coils are self-supporting. The machine is provided with automatic fault-detecting and indicating devices.

* ELEC. REV., August 16th, 1918, and subsequent issues.

THE RÖNTGEN SOCIETY.

AT the meeting of the Röntgen Society on January 7th, Dr. H. S. ALLEN, D.Sc., gave an address, accompanied by many experiments, on electrical changes produced by light. He said that according to the modern view matter was assumed to be built up of discrete electrical charges. With the negative electron they were all acquainted, but as to the ultimate positive charge they were still in ignorance. Yet there was no doubt that there was an ultimate positive charge, and that matter itself was composed of these positive and negative electrons; so that any electrical change might include a whole series of chemical changes, and, in fact, it was difficult to see whether any change with which they were acquainted in connection with matter was not an electrical change. Photo-electricity was a wide term, but it might be restricted to signify the liberation of electrons by light, a phenomenon which first began to be noticed more than 30 years ago. Dr. Allen went on to show that a body which was positively charged retained the charge when illuminated by ultra-violet light, but when the charge was of the opposite sign, there was immediately a discharging action on exposure to such light. In the case of wave-lengths of light longer than the characteristic frequency of the metal sodium, corresponding to the green light of the spectrum, there was no emission of electrons at all, but with light of shorter wave-length than this—that is to say, from green on towards the blue and violet—electrons were emitted. With regard to the phenomena of luminescence, he said that these were divided into two classes according to the length of time for which the luminescence continued. If the luminescence ceased with the cessation of the exciting cause, the term fluorescence was used, and if it continued after the stimulus had been withdrawn it was known as phosphorescence. Luminescence was due to some electrical action. The theory was that the exciting light produced photo-electric separation of the electrons, which in some cases returned almost at once to the parent atom, and on their return brought about emission of light of somewhat longer wave-length, which was known as fluorescence, while others did not return immediately, being entangled for a time in the surrounding molecules of the substance, and these on their more tardy return to the original support gave rise to phosphorescence. There was also such a thing as delayed phosphorescence, which implied that the electrons had become attached to foreign atoms and remained there pending some fresh stimulus; the explanation of the latent image of the photographic plate might be found in this theory.

In the course of the discussion, Dr. LEONARD LEVY said that if two preparations of zinc sulphide were prepared in exactly the same way, save for the variation of one little factor, while both samples would fluoresce brilliantly when

exposed to green light, yet when exposed to red light, in the one case the fluorescence would be undiminished, and in the other case practically extinguished. It was difficult to see why so small a difference in preparation should cause such radical difference in behaviour in one respect and not in others.

Prof. A. W. PORTER thought that probably no pure substance ever did fluoresce. It was a statement hard to prove, but it was borne out by the fact that the fluorescent property of any substance seemed to depend upon the presence of traces—even extremely minute traces—of impurity.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

The Need for Co-operation Among the Smaller Manufacturers.

I trust you will find space for a reply to Mr. Siddeley's letter in the current issue of your paper on the subject of co-operation.

Mr. Siddeley's remarks are, on the face of them, quite unexceptionable, but I think it is advisable to look a little further, and consider what is likely to be the effect on the national character of carrying out the policy of specialised production and combination which he advocates.

I would ask you two questions:—What enabled us to beat the Boche? and Why was America so slow in getting started? I think the answers to these questions are complementary. We beat the Boche by directing to a common end the intense individual initiative of each British man or woman. The Americans were so slow in getting to work because, owing to specialised production on a large scale, they lacked the training which alone can produce this individual initiative and expert knowledge. In this country there was an immense number of small firms, each with its technical staff, and each capable of enormous expansion. Each little firm provided a nucleus from which radiated the ever-widening circles of increased production.

It is notorious that the Americans suffered from lack of skilled men, and that they are the slowest nation in the world to get going in anything that is not their standard production.

Our national system has produced, in fact, a people who could catch up, and pass, in an astonishingly short time the nation which had planned and organised war for 40 years. In spite of the warning which America had, and the experience of the other nations who had been at war for more than two years, they not only made many of the same mistakes, but many additional ones, and had not, in their first 12 months, produced anything comparable to the efforts of Britain or France.

If you turned the national capacity for manufacturing in this country into a few gigantic concerns, you would gradually lose what really constitutes the genius of our people, namely, the individual capacity of each man. This is what has occurred in America. These arguments apply to every field of endeavour, industrial, financial, or military. It is not true to state, as you did in your leading article of January 3rd, that the immense output obtained during the war was due to co-operation between different concerns. It was due to the enormous expansion of manufacturing capacity. Each individual has produced per head (with the exception of the managing staffs) a great deal less per day during the war than in peace-time. Further, it is a great mistake to imagine that the large firm produces cheaper: in fact, the limit of economical labour cost is very soon reached, and it is only in supervision, tools, &c., the cost of which can be spread over a larger number, where economy may be secured. For instance, any individual man working his whole time on one job will produce at the same cost, whether he is one of two, or 20, or 200.

In the direction of supervision, one foreman can only look after so many hands, so that if 100 is the limit, there is nothing to be gained by having 200 men and two foremen.

I think that the following statements are generally true:—

1. The industry of this country has been built up, and is even now carried on, chiefly by small concerns.
2. Standing charges are generally heavier in comparison to output with larger firms than with small.
3. Each individual of the staff of a small firm is more efficient and does more work.
4. Small firms are more flexible and adaptable.
5. Small firms make a larger average profit on their turnover than large ones.
6. In quick delivery and promptness in every department, a small firm scores all along the line. The only direction in which a large firm scores is in its advertising and selling departments.

Combinations without capital fusion have not proved satisfactory in electrical concerns. The number of articles would differ so greatly in design that unless you can completely eliminate a large proportion, you will get no economy in supervision and designing staffs to set against the cost of the central management which is super-imposed on the original ones.

Another vitally important advantage possessed by the small firms is the relation between the management and the men. I think it will be found to be true that the cases of trouble with the men in the smaller firms during the war are extremely rare, and the output per head of the manual workers has been much larger.

Again, excessive standardisation is against improvement and progress. Every firm knows the temptation not to introduce improvements when it involves scrapping standard patterns. The whole fact of the matter is that, having to turn out millions and millions of articles all alike has sent the country quite mad on organisation and standardisation. I should very much doubt if the actual output of all the electrical firms, of purely electrical machinery and accessories during the war, has largely been increased. Engineering products are not like wheat, or pipes, or other articles in universal use, which are not likely to change in character. The successful large combinations such as cotton spinners, cotton thread, and linseed oil have not been instrumental in lowering prices, but, on the contrary, have been successful because they have kept the prices up, due to a practical monopoly of production.

The large electrical concerns in this country have been notoriously unsuccessful compared to the smaller ones. The Government interference with engineering industry merely increased production, and prevented the use of materials and machinery on goods not connected with the war, and has not produced any economy, but rather the reverse. It was chiefly of use in providing unlimited capital for the expansion of concerns. The large firms are, in their unwieldy character, red tape, and in general inefficiency very like the Government. I do not wish to suggest that there is not room for vast improvement, but it seems to me that the directions in which our efforts at improvement should be made are in improved education and training of individuals, increased efficiency in our factories, and co-operation between the masters and the men due to common interest. Once you educate the men to see that they can only maintain a higher standard of living by increased production, and when they are given an interest in the profits of the firm for which they work, we shall soon begin to secure more efficient production. The danger of losing the British characteristics of initiative and tenacity by vast combinations and inefficient State control are, to my mind, most serious.

Apologising for the length of this letter,

E. N. Bray.

London, N.E., *January 11th*, 1919.

The Westinghouse Manager and Engineering Output.

I read the note on the above subject in your issue of December 27th with interest in the most vital points mentioned by Mr. Mensforth, in his reference to the future of our engineering industry. I agree that there must be years of ample trade ahead, as we must manufacture to carry on and pay our dues. Referring, however, to his remarks *re* Ca' Canny methods and restrictions, I agree from personal experience that both have been very much in evidence for some time, but Mr. Mensforth does not make any remark as to their cause, though he knows a deal, having such close touch with his own employés, through the medium of his Works Improvement Committeemen. As the average artisan knows so little of how departments or factories have to be handled to make them pay, the remedy is to take the employés in hand somewhat on the same lines as he did with his own foremen, and teach them a little of what it is necessary for them to know; let him understand what his faults cause, and how loss or waste time reflects on the profitable side of any business. To get attendance at these meetings would be a big job, I suppose, unless they were made attractive. Perhaps the shop stewards being elected up and down the country, or workshop committees, could assist.

Referring to customers placing orders, was not an order sent abroad some years ago on account of the employers forming the Electrical Engineering and Allied Trades Association? Now the workers are watching the number of firms who are linking up from time to time, and wondering how it will affect them later on. Regarding the skilled men's Union, I do not believe any instruct or advise restrictions on output, but they do realise that maximum output is the employers' interest, but, in many cases, not the skilled men's interests, as the number of men who are in receipt of wages in excess of the standard *minimum* rate is very small. But if the employer will put down modern machinery and pay more on individual ability than he has done, the same as America, as he mentions, then I believe the 47 hours and the dividend of employers would be assured. I say: Clear the mists from the Unionist's eyes, and let him see things more clearly, and understand why, and demarcation, another serious obstacle, may be removed. I might also add: Keep their gates more open to other firms, so that firms can always be kept up with the latest improvements, as has been done during the development of munition manufacturing.

An Old Foreman who Benefited Some by H. M.'s Lectures.

Electric Pressure Regulators.

We are inclined to think that your correspondent, "Engineer," will not find an automatic voltage regulator successful with the class of turbine he describes.

Our own experience has been wholly unsatisfactory. We first installed a Tirrill regulator, and kept to hand governing, the turbine attendant keeping the speed normal within about 2 per cent. with a periodicity indicator to guide him; this arrangement worked very well with a load that was previously giving us considerable trouble. After the war started we had to adopt automatic governing, owing to shortage of men, and we installed one of Messrs. Gilkes's turbine oil-pressure governors; this governor is quite useful, but we have tried about every combination of adjustments that is possible on these governors, but cannot get it to work with the Tirrill regulator in circuit, or, shall we say, it works far more than is needed.

It is only fair to Messrs. Gilkes to add that the alternator-rotor does not provide more than about one-half the flywheel effect that is really needed, nor have we a relay relief valve on the turbine; on the other hand, Messrs. Gilkes's engineer mentioned that in another installation they had to abandon the electric regulator owing to the turbine hunting.

Fixed up as we are now, we depend entirely on the governor for those portions of the day when the load is not subject to rapid changes, but on other occasions we have to come back to hand governing and the Tirrill regulator, a very poor makeshift, as when the governor would be of the greatest service to us we are unable to use it.

With an electric pressure regulator in circuit the speed of a machine will vary to a greater extent for a given load change than without one in circuit, as the turbine makers say the variation in speed is out of all proportion to the change of load, and the governor deals with it as a heavy load change when in fact the change of load may not exceed, say, 1 or 2 per cent.; the consequence is excessive and continuous hunting.

It appears to us that the only condition that will meet the case is the addition of a fly-wheel at least double the weight that would be used normally. We know there are cases where governors controlling high-pressure jet turbines are working very well with electric pressure regulators in circuit, but our turbines are like "Engineer's," with heavy gate gear to operate, where the speed can vary considerably before the governors can correct it.

Lynton & Lynmouth Electric Light Co., Ltd.
P. T. KIMMINS.

Lynton, *January 11th*, 1919.

The "Taylor System."

The iron heated by Major Pells in your current issue should be struck while it is hot.

Too little is known about Fredk. Winslow Taylor's work in this country, and if we are to have our share of the world's work in the future we have to catch up, not only America, but France, too, in the matter of scientific management.

The Taylor system was introduced into France 10 years ago at one well-known automobile works, and others promptly followed suit, until—two years before the war—Taylor himself was invited by the French Government to advise them as to the organisation of one of their principal arsenals.

Compare with this the prevailing impression here that the Taylor system is a sort of "glorified card index" (I have heard it so described by a leading engineering manufacturer), and the fact that until recently—if not still the case—it has been introduced into only one English works.

In conclusion, my object is to suggest the formation of a "Taylor" club or society for study and propaganda purposes.

F. Maurice, Sec.-Lt., K.L.R.

Hendon, N.W. 4, *January 13th*, 1919.

Fault Localisation.

What is the best method of localising a break on one conductor of a twin underground telephone cable with *no earths*—*i.e.*, sound insulation?

January 13th, 1919. **Ajax.**

Engineers' Salaries.

"Wanted, by leading insurance company, Electrical Engineers. Must have experience of A.C. and D.C. machinery, and workshop training. Commencing salary £150 per annum plus £35 war bonus, with increases according to merit."

I should like to point out that stokers under me are in receipt of over £200 per annum, and are now applying for 8s. 6d. a week increase! I think that the money offered above for the qualifications asked for would disgrace a Hebrew moneylender, let alone a "leading insurance company," and, personally, I would rather work on a farm for 30s. a week.

A. J. Abraham,
General Manager.

Electricity Works, Aberdare, *January 10th*, 1919.

Moisture in Low-Grade Fuel.

In many generating stations and works where mechanical stokers are in operation (especially so in the case of those of chain-grate type) it is the practice to burn very low grades of fuel, in many cases the residue of coal-washing plants. These low grades are delivered to the consumer in a more or less saturated state, and are thereby the cause of a not inconsiderable amount of loss.

Let us take for illustration a case where fuel contains 5 per cent. of moisture, *i.e.*, in every pound of the mixture delivered there will actually be .95 lb. coal and .05 lb. water. Suppose the calorific value to be 12,000 B.TH.U. per lb. (dry coal); then as each pound of the mixture will only contain .95 lb. of coal, the calorific value will only be 11,400 B.TH.U., giving a heat loss of 600 units per lb. of the mixture, 1,344,000 units per ton.

Again, the moisture fed into the furnace will have to be evaporated, which will entail a further loss of heat units. We will assume that the temperature on entering the furnace is 50 deg. F., then each lb. of water will require 212+966−50=1,128 units for evaporation at atmospheric pressure. We have seen that the mixture contains 5 per cent. moisture, *i.e.*, each ton will contain 112 lb.; therefore 112×1,128=126,336 units expended in evaporating moisture present in a ton of the mixture, neglecting the further loss in superheating the steam generated.

Collected losses =

By loss of weight	... ...	1,344,000 units.
By evaporating	... ...	126,336 units.
Total loss per ton	...	1,470,336 units.

There is, therefore, roughly a loss of 5½ per cent. which might be partly recovered, to say nothing of extra cost of handling this type of fuel, danger of holding up in bunkers and choking of hopper feeds, and also corrosion to ironwork in heated localities.

The question is, does the low first cost of this type of fuel justify its use in preference to fuel of a higher grade, having a higher calorific value and smaller percentage of ash, thereby being also cheaper to handle? If so, would it not pay to install some method of saving the loss of evaporation by extracting the moisture before conveying the fuel to the furnace? The moisture would have to be extracted by evaporation or mechanically, and evaporation should be favoured, as waste heat could be used. It is very doubtful if the saving would justify the expenditure of heat necessary to operate a mechanical process, such as, for instance, the process used for drying grain, where centrifugal force is used. Perhaps a combination of the two methods would be successful, heat being brought into contact with the fuel while it was kept moving on a form of conveyor belt, the latter being designed to allow the passage of hot gases through the body of the fuel. Of course, care would have to be exercised to prevent the fuel being conveyed to the bunkers at a temperature liable to facilitate spontaneous combustion.

Leonard P. Morinan.

Cardiff, *January 13th*, 1919.

Electricity on Board Ship.

A paragraph at the top of page 30 in your issue of the 10th inst. reminds me that, over 30 years ago, I carried out successful experiments at Sheerness and Shoeburyness with gun-training gear which was tested and approved by the War Office, who ordered platforms for heavy guns at Dover and Spithead forts to be provided with fittings for motors and other apparatus designed by me; but a fresh man was appointed to Woolwich, and, as he preferred compressed-air, the electrical scheme was shelved.

The Admiralty was informed of what had actually been done by electricity at Shoeburyness with its own 35-ton turret-guns; but the gunmakers favoured hydraulic machinery, and so there was "nothing doing" for me!

As I am not financially interested in any one method of ship propulsion, will you allow me to record my disagreement with your view that "the electrically-propelled battleship . . . . marks an engineering advance"?

Wm. H. Massey.

Twyford, Berks., *January 12th*, 1919.

My attention has been drawn to the interesting leading article appearing in your issue of the 10th inst. on the subject of the electrical propulsion of the U.S. battleship *New Mexico*.

As the inventor of the polyphase alternating-current system of ship propulsion used on the *New Mexico*, and for which "system" patents were granted to me in no less than 19 countries, long before the American engineers even dreamed about the new ship propulsion methods, I must respectfully protest against the statements of Secretary Daniels when he states, before the American Senate, that it is due to American intelligence and invention that the world owes this much more efficient means of warship propulsion and handling, together with all the many advantages which come in the train of evolution.

All the advantages which the *New Mexico* has undoubtedly shown as regards economy in fuel, handling, and military improvement were pointed out by me before the large meeting of Naval Engineers at Chatham in 1909, at which meeting my friend Mr. Purser Fletcher (now Assistant Director of Electrical Engineering at the Admiralty) took the chair.

The only difference was that I estimated that there would be a saving in fuel in the case of a battleship installation of my "Paragon" system of 26 per cent.; I was not far out, as it now appears that the actual saving in fuel, compared with the old-fashioned steam turbine-driven ships, has proved in the *New Mexico* to be no less than 25 per cent.

It was to my office in Bush Lane, in 1909, that my friend Mr. Hobart (now consulting engineer to the G.E.C. in America, who have supplied the machinery for the *New Mexico*) came with his assistant, to learn all about the "Paragon" system, as he said he was amazed at the claims which I was then making concerning my invention. He was, however, perfectly satisfied with the explanation which I was fortunately able to give him, thanks to my foreign travels in connection with steam turbine tests (then kept a great secret in this country).

Although the American engineers should get great credit for their excellent work, which I, for one, will grant both Mr. Emmett and Rear-Admiral Griffin, both of whom are well acquainted with my claims as inventor of this original ship propulsion system, and although many letters have been received by me from many foreign countries recognising me as such, I note with regret that no mention is made of my work in this connection, even although I have successfully contested patent applications for my system; the result of the last case was published in the ELECTRICAL REVIEW on August 1st, 1913.

In my opinion, it is the lack of knowledge of modern polyphase alternating-current work in the British Navy which is the reason of the slackness in the adoption of these new ideas, coupled with the fact that builders of the ships are looking after their own interests, because they think that they will lose orders for the plant which would otherwise be made in their own shops.

William P. Durtnall.
Late Lieut., R.N.V.R.
H.M.S. *Vernon.*

London, S.W., *January 11th*, 1919.

THE NAVIGATIONAL MAGNETIC COMPASS CONSIDERED AS AN INSTRUMENT OF PRECISION.*

BY M. B. FIELD, O.B.E., M.INST.C.E., M.I.E.E.

THE problems involved in the mariner's compass are of great variety; we have, for example, problems of an essentially practical nature in mechanics and mechanical construction, the wear and tear of materials, the effects of vibrations of an exceedingly complex character; considerations of fluid friction, viscosity, and fluid motions; terrestrial magnetism; the magnetism of iron and steel; the fields of force and systems of magnetic potential due to complicated arrangements of magnets or the equivalent; and so forth.

Ordinarily, we expect a magnetic needle to tell us the direction of the magnetic force in the region in which it is placed. If the field in question is the undisturbed field of the earth we may expect any well constructed and suitably supported needle to give us correctly the direction of the meridian. Its precision will depend upon the accuracy of workmanship, and freedom from pivot friction, and its error may be reduced to the same order as the error of unaided observation.

In the case of the navigational compass very much more is required. In the first place, the ship itself is magnetic, and the magnetic force at any selected station not only differs in direction from the meridian, but as the ship swings round the force undergoes cyclic changes, both in magnitude and direction. Further, the amount of the deviation of the magnetic force from the plane of the meridian not only depends upon the course the ship may be steering at the time, but also upon her absolute geographical position.

Again, the ship's shape and proportions, the locality in which she was built, the direction of her head while under construction, in short, her past history, and particularly her recently past history, are all factors that influence her magnetic state.

Thus, the duty we require the compass to perform is no easy one; surrounded as it is by disturbing influences, we require it to ignore every misleading suggestion and to point unhesitatingly to the magnetic north.

If we annul by magnets, or otherwise, the effect of all the magnetism of the ship, and this annulment remains effective on all courses, with the ship upright or listing, and at all parts of the earth, we obtain complete compensation; or, again, if we neutralise the east-westerly component of the ship's magnetism, and the neutralisation is effective under the above conditions, the compass is completely compensated.

In practice, we annul some of the components of the ship's magnetism, and neutralise the east-westerly force of others, in such a way that the compensation is very nearly complete on all courses, no matter whether the ship be upright or not, and the correction remains good at all parts of the earth—provided the so-called permanent magnetism of the ship remains permanent, and the so-called induced magnetism is strictly proportional to the inducing force, and vanishes when the inducing force is withdrawn.

Unfortunately, we find that the permanent magnetism is not *permanently* "permanent," and the induced magnetism is not *instantly* "transient," and our *complete* compensation is to this extent incomplete.

Much of the permanent magnetism said to be "hammered" into the ship in the course of building is "shaken" out of her during her first few voyages, while magnetism of a semi-permanent character is "picked up" by a ship sailing for days together on a given course, and is only gradually lost, it may be over a period of hours, or even days, when the course is materially altered.

Further examples of permanent magnetism being "shaken" out of a newly-built ship are furnished by the great change in the magnetic character of a new warship when undergoing gun-firing trials.

The precision of the navigational compass is, therefore, not only dependent upon the accuracy with which its "correctors" perform their function of compensating for the ship's normal magnetism, but it is also dependent upon what Lord Kelvin called "unpredictable irregularities due to variations of the permanent magnetism, and to retention of some of the transient magnetism when the inducing influence is past."

No instrument is altogether immune from unpredictable irregularities, and just as the painstaking observer is ever on the alert to detect an aberration, to measure its amount, and to trace its origin, so the careful navigator will be on the watch for changes of the magnetism of his ship, and will regularly avail himself of opportunities afforded of taking sun, moon, or star observations for the purpose of checking the readings of his compass.

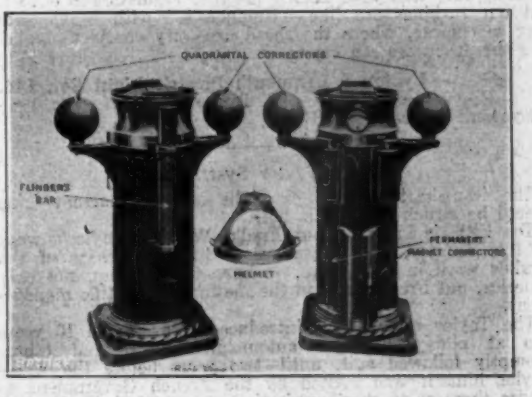

FIG. 1.—COMPASS BINNACLE, SHOWING CORRECTING DEVICES.

Lord Kelvin became intensely interested in the mariner's compass; he began an article in "Good Words" in 1874, and after dealing with the historical portion of the subject, the article stopped—to be continued only after five years. When he broke off his article he had arrived at the conclusion that the mariner's compass, as used in iron ships, ought to be an instrument of precision, but was not, and he set himself the task of devising a new compass which might fairly lay claim to be an instrument of precision. In concluding the article, he described the improvements in the construction of the mariner's compass and its accessory apparatus which he had devised during the intervening five years.

In 1839, Airy (later Sir George Airy), Astronomer Royal, wrote a paper on the deviations of the compass in iron ships, and propounded means for approximately correctly compensating a compass (with short enough needles, and small enough magnetic moment) for errors which arose, due to the ship's magnetism. Airy's method was quickly adopted in the iron ships of the merchant service. Certain difficulties, however, soon became manifest to expert compass adjusters, arising from the use of magnetic correctors, and it was found impossible in certain cases to obtain a correct compensation.

Errors of two kinds were introduced by the design of compass employed, one depending upon the length of the needle, the other upon its magnetic moment.

When selecting a suitable place for a compass station on board ship, due care is taken that the nearest iron is at a relatively great distance, so that if magnetised, it gives rise to a magnetic field at the compass station which may be

* Abstract of lecture delivered before the INSTITUTION OF ELECTRICAL ENGINEERS, London, January 9th, 1919.

regarded as uniform over a region considerably larger than that swept out by the compass needles when rotated on the card pivot. Moreover, the nearest iron must be sufficiently remote to ensure that there is no sensible attraction of the needles due to magnetism induced in the iron by the needles.

When these conditions are duly observed, the position of equilibrium of the uncompensated card does not sensibly depend upon whether the needles be long or short, or whether their magnetic moment be large or small, but merely upon the direction of the resultant magnetic field acting at the compass station.

The compensation of the compass by Airy's method is effected by placing magnets and masses of iron near the

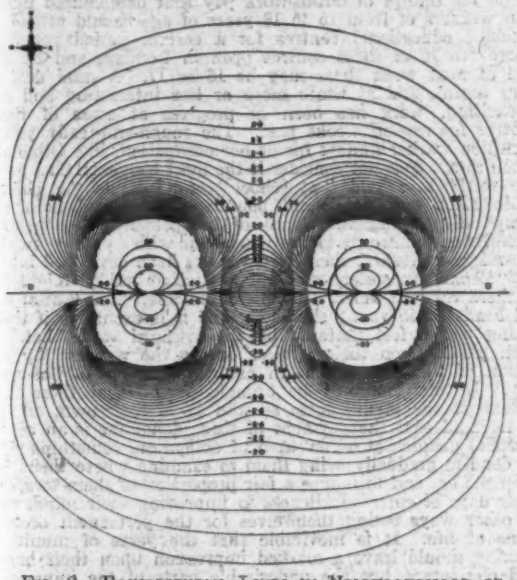

FIG. 2.—EQUIPOTENTIAL LINES IN NEIGHBOURHOOD OF COMPASS, SHIP ON N.-S. COURSE.

compass in positions calculated to produce magnetic forces in the region swept out by the card needles, which exactly counter-balance the deviating forces, due to the magnetism of the ship's ironwork. In order that the system may not become unwieldy and impracticable, it becomes necessary to place magnets and iron masses of considerable size very near the compass, in fact they are incorporated as part of the compass binnacle (see fig. 1).

Now, the magnetic fields to which these give rise are by no means uniform over the region swept out by the needles

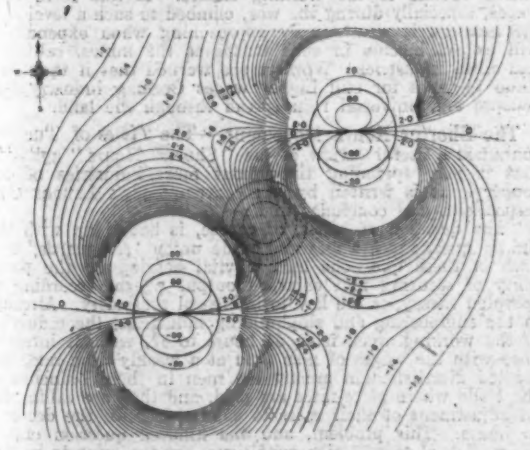

FIG. 3.—EQUIPOTENTIAL LINES, SHIP ON QUADRANTAL COURSE.

of a long-needle card, with the result that a short needle will have a different position of equilibrium from that of a longer needle.

For example, it is usual to employ two cast-iron spheres attached to the binnacle for the correction of one of the effects of ship's magnetism, viz., the quadrantal effect. These spheres may be 8 in. diameter, placed on either side of the compass at about 12 in. from the card centre, and level with the card. They become magnetised by the earth's field, and behave, so far as external points are concerned, as extremely short magnets of definite magnetic moment always pointing along the line of resultant magnetic force.

Now, we may draw the lines of magnetic force and lines of equal potential-values due to such a system. Equi-potential lines are exhibited in fig. 2 for the case where the line joining the centres of the spheres is E.-W. (magnetic); it will be seen that this field is by no means uniform. A uniform field would be represented by a family of straight, parallel, and equidistant equipotential lines. We thus employ a non-uniform field, such as that shown in fig. 2, to correct the compass for the deviation produced by a perfectly uniform field arising from some effect of ship's magnetism.

Fig. 3 shows the equipotential lines due to the magnetisation of the globes when the ship is steering a quadrantal course.

Fig. 4 represents the effect when the ship is on an easterly or westerly course. In all cases, 2, 3, and 4, the interesting part of the field is where the dotted circles are drawn; this

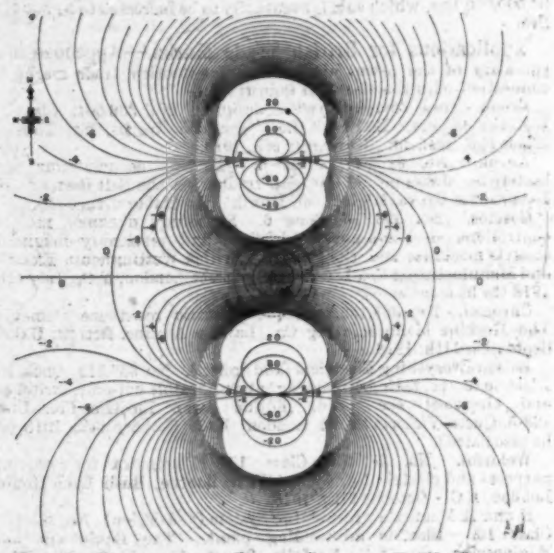

FIG. 4.—EQUIPOTENTIAL LINES, SHIP ON E.-W. COURSE.

is the position of the compass card. The smallest dotted circle represents the area swept out by needles 4 in. long; the intermediate circle corresponds to 6-in. needles, the largest circle to 8-in. needles.

The un-uniformity in this region is sufficient to account for appreciable secondary errors when using needles of considerable length.

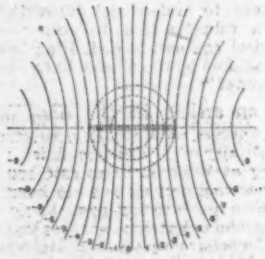

FIG. 5.—EQUIPOTENTIAL LINES IN PLANE OF CARD 50 CM. ABOVE MAGNET.

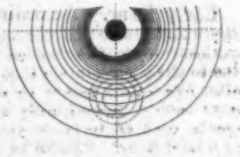

FIG. 6.—EQUIPOTENTIAL LINES DUE TO FLINDER'S BAR.

Fig. 5 illustrates the family of equipotential lines in the plane of the card due to a corrector magnet placed 20 in. below the card. In this case the field of force is very nearly uniform over the region in which we are interested.

Again, another effect of ship's magnetism is compensated by what is termed the "Flinder's bar," a long, straight, vertical bar 3 in. in diameter, perhaps 16 in. long, and only 10 in. from the card centre, the upper end being usually nearly level with the card.

Such a bar becomes magnetised by the vertical component of the earth's field, and gives rise to lines of equal potential in the plane of the card, as represented in fig. 6, again a field of force very far from uniform.

Further, these iron correcting masses are sufficiently near for a needle of large magnetic moment to induce magnetic effects in the correctors, which, reacting upon the needle, will sensibly affect its position of equilibrium.

We have then to remember that correctors, while introducing magnetic forces which neutralise those due to the ship, introduce additional forces which may produce deviations, depending on, (a) the length and arrangement of the magnetic needles, (b) the magnetic moment of the needles.

(To be continued.)

BUSINESS NOTES.

Italian Companies.—There has been formed at Turin the Società Idroelettrica Valle del Liri, with a capital of 100,000 lire, for the development of certain water rights. The company is an offshoot of the Società delle Cartiere Meridionali.

The Società Anonima Ligure Piedmontese di Elettricità e Gaz has removed its offices from Turin to Genoa.

The Società Méridionale di Elettricità has decided to increase its capital from 50,000,000 to 80,000,000 lire, with eventual augmentation to 100,000,000 lire. The scope of this company's operations embraces the Provinces of Calabria, Basilicata, and Puglia, and will eventually extend to Lybia and the East.

In order to improve and enlarge its installations at Vizzola and Turbigo, the Società Lombarda per Distribuzione di Energia Elettrica, of Milan, has increased its capital from 26,000,000 to 32,500,000 lire, which sum is eventually to be increased to 52,000,000 lire.

Applications for British Trade Marks.—Appended is a summary of the recent applications for British trade marks in connection with the electrical industries :—

Brook (word combined with design). No. 386,004, Class 6. Electric motors. E. Brook, Ltd., Empress Works, St. Thomas Road, Huddersfield. November 9th, 1918.

Aurun. No. 385,347, Class 6. Electric accumulators and batteries. Johanne M. Cornelis, trading as the Bell Battery Co., Laburnham Grove, High Road, Ilford. September 27th, 1918.

Cosmos. No. 378,826, Class 6. Stationary dynamos, motors, controllers, electric-brake mechanism, and stationary magneto-electric machines and their parts. British Westinghouse Electric and Manufacturing Co., Ltd., Norfolk Street, London, W.C. July 4th, 1918 (to be associated).

Chromel. No. 385,155, Class 8. Electric resistance elements. The Hoskins Manufacturing Co., Lawton Avenue, Detroit, U.S.A. September 11th, 1918.

Edison Everything Electrical (and design). No. 385,519, Class 13. Electric lamps, fittings, sparking plugs, fusible cut-outs, switches, and electrical accessories. Edison Swan Electric Co., Ltd., 123-5, Queen Victoria Street, London, E.C. October 9th, 1918 (to be associated).

Weldrics. No. 385,561, Class 13. Electrodes for welding purposes and electrical fittings. W. H. Boorne, Bush Lane House, London, E.C. October 11th, 1918.

E. and E. Magnetic Arc-welding System (and design). No. 385,425, Class 16. Electric arc-welding plant. The Equipment and Engineering Co., 2-3, Norfolk Street, Strand, London, W.C. October 3rd, 1918.

Autogen. No. 385,800, Class 48. Adhesive tapes for electrical insulating purposes. David Brown, jun., 45, Hope Street, Glasgow. October 25th, 1918 (to be associated).

Our Letters from the Forces.—Among our correspondence from men with the Forces this week, is a letter from a "Staff-Sergt., R.E.," in Scotland, in which the writer says :—"I wish to thank you for so kindly sending me a copy of the REVIEW regularly each week. The REVIEW is much appreciated in this office, and helps to keep one in touch with electrical matters whilst on Active Service. Until one's return to professional duties the REVIEW is proving itself to be a valuable link between the 'military engineer' and the electrical engineer in civil life ; but will service in H.M. Forces be recognised by those who have the settling of appointments in their hands?"

Early Door.—According to an article in the *Sheffield Daily Independent* on the Sheffield workers' demands for a shorter working week, the decided unpopularity of a 5.30 p.m. finish is due to the consideration that staying at work the extra half-hour after five o'clock means to many men that they cannot get home, have their teas, and dress up in time to get to first-house amusements, or even to other gatherings and entertainments that start at a later hour. "There is reason to believe that a solid attempt will be made sooner or later, and probably in the not distant future, for a 44-hour week."

Of course, we all agree that "All work and no play makes Jack a dull boy." It has been found in cases profitable to close a works on Saturday, so that the employés could devote themselves unreservedly to football or cricket. Let us close early at night, so that they may go to the theatre or the kinema! What else matters?

Dissolutions and Liquidations.—MIRFIELD GARAGE AND ELECTRIC WORKS, LTD.—Winding up voluntarily. Liquidator, Mr. H. Appleyard, Market Place, Dewsbury. Meeting of creditors, January 22nd ; claims by February 7th.

LEITNER ELECTRICAL CO., LTD., Maybury, Woking.—First meetings of creditors and contributories, January 21st, at Carey Street, W.C.

Trade Announcements.—MR. F. W. ATKINS, who has been discharged from the Army, has commenced business as an electrical engineer at Harford Road, Lampeter, Cardiganshire.

MR. J. PAIN, electrical engineer and contractor, having been released from the Forces, has resumed business at 101, High Street, Hythe, Kent.

MR. E. F. BRETT, electrical engineer, having returned to Doncaster, has resumed business at the back of 144, St. Sepulchre Gate.

MR. J. P. COATS, electrician, having been released, has resumed business at 17, East Street, Okehampton, Devon.

Export Restrictions Relaxed.—The *London Gazette* for January 10th contains a notice of further relaxation of export restrictions.

Pottery Electrical Men's Wages.—By an award of the Court of Arbitration, the wages of the Electrical Section of the National Society of Pottery Workers at Hanley have been increased to 60 per cent. over pre-war wages. The workers wanted the 12½ per cent. and 7½ per cent., which are now merged into the 60 per cent., to be granted in addition thereto, as they contended that these bonuses were granted to encourage good time-keeping.

The Exportation of Magnetos.—The Board of Trade announces that magnetos and component parts thereof have been removed from List B (export prohibited to countries outside the British Empire) to List C (export prohibited only to neighbouring enemy countries).

The Juvenile Munitioner Changes Over.—It is a condition for receipt of out-of-work pay that demobilised munition workers of from 15 to 18 years of age should attend at specified educational centres for a certain period per day. There are 10 of these centres open in London, and by the end of next week there may be 16 or 17. A good deal of very useful, and at times more or less interesting and not unexciting, work has been in progress at some of these centres for several weeks past. The rough-and-ready young munition worker finding his or her occupation, like Othello's, taken away, does not consider it the most congenial change in the world to attend "at school" and become "a child" again after earning several pounds a week and living in comparative affluence. Sense of independence has grown, restraint been thrown to the winds, and with a year or two of growing importance, these war-workers have developed into a new element in society which if not wisely guided might be, in these volcanic times, a little troublesome. You cannot put old heads on to young shoulders, and it is excusable if these young people feel flattered by the artificial value that has been placed upon their services during the war and by the action of the Government in assuring them of out-of-work pay. If they can only be brought to see that there is a bottom to the public purse as well as to their own, and to understand that the payment of these donations is an act of national generosity rather than of obligation, something may be done to gradually bring them to examine where their real interests lie, and to induce a fair proportion of them to spend their days of enforced idleness in improving their minds and in other ways fitting themselves for the permanent occupations of life. It is inevitable that the years of munition-making should leave a marked impression upon their habits and characters, but the undesirable parts of the impression may be modified or even turned to good account under capable leadership. It was remarked at an Educational Conference in London on Monday that the work is in many ways the continuation school problem. That may be, but those responsible for it have a duty which at this moment is more important even than that, and requires patience, experience, and tact.

The German Economic Situation.—In our article on another page to-day we quote a German authority as reproving the Government for favouring the excessive demands of the workers. The *Daily Mail* states that demands for extravagant increases in wages have reached such a stage that the Socialist Government of Prussia has issued an official and drastic rebuke to the working classes. It sets forth that wages, especially during the war, climbed to such a level that the moment is now rapidly approaching when expenditure will exceed income in such trades as the mines, railways, and allied industries. Workers are warned that if they continue to press for still higher wages German industry will collapse and universal ruin spread through the land.

The Shorter Hours Movement.—The *Times* of Tuesday contained a useful review of the "Shorter Hours" agitation that is now spreading throughout most industries of the country. It is written by our contemporary's Labour Correspondent, and concludes thus :—

"The question of hours, of course, is bound up with the thorny question of wages and trade union 'safeguards,' and both of these questions have a vital bearing on the possibility of securing that enlarged output which, according to accepted theory, is the key to industrial prosperity. Already, in the engineering and shipbuilding industries, the reduction of the working week from 54 hours to 47, without interference with the wages of men paid at a weekly time rate, has created dissatisfaction among the men in those branches of the trade where piece-rates are paid, and they are calling for an adjustment of their rates to counter-balance the decrease in hours. This problem, and the kindred question of the restoration of trade union conditions, are too large to be discussed here, but, in the case of the trades which have to face foreign competition, though not to the same degree in the other cases, they are inseparable from the question of hours, and should therefore be tackled concurrently. The spirit in which they are faced by all parties, and the speed and smoothness with which they are solved, will have an important, if not a governing, influence on the industrial outlook of the coming months."

Mr. George Steel, the works manager of Messrs. C. A. Vandervell & Co., Acton Vale, suggested to the staff that they should hold a secret ballot on the 47-hour week. The shop stewards, in conjunction with the management, supervised the voting, which resulted in the 7.30 to 5 p.m. scheme being selected by a very large majority. Not a single paper was spoiled.

Fuller Social Welfare.—The second concert and dance of the season arranged by the Works Social Welfare Committee of the FULLER ACCUMULATOR CO., LTD., Chadwell Heath, E., was held at the Canteen, Woodland Works, on Tuesday, January 7th, Mr. E. G. Lind presiding. The programme was entirely provided by the employés. So far, the interest taken in these events by the workers has been very keen, so that both of the entertainments have been a great success. The somewhat difficult question of funds to cover the cost of any entertainment, &c., which might be arranged, was solved by the workers themselves, who suggested that a collection be made at any entertainment, and this method of covering out-of-pocket expenses has been perfectly successful. The Fuller Social Welfare Committee has been in operation for about two months, and is not only arranging for concerts, dances and entertainments, but any employé can put before the Committee suggestions for the improvement of the working and social conditions, with full confidence that questions thus brought forward will receive every consideration. When the Committee was first formed representatives from various departments of the works were elected to represent the workers on the Committee. The Committtte has already been the means of arranging improvements in certain factory conditions, and is negotiating with the local authorities respecting improved services to the works, which will not only benefit the factory in particular, but the community in general. The directors of the company have very considerately met any proposals that have been advanced, and they have materially helped in negotiations with the local authorities.

D.K. Recreation Park at Preston.—MESSRS. DICK, KERR AND CO., LTD., of Preston, have purchased the Ashton Park Estate, Preston, which consists of about 90 acres, with a view to developing a portion as a recreation park for their employés. It is possible that a part may be utilised for providing housing accommodation on garden city lines.

Belfast Electrical Men Want 44-Hour Week.—The electrical workers of MESSRS. HARLAND & WOLFF, MESSRS. WORKMAN & CLARK, and other big Belfast firms, have sent deputations to these firms in connection with proposals for a 44-hour week.

Patent Application.—Steel Utilities (Inc.) has applied for restoration of Patents 22,067 and 22,068 of 1913, granted to T. P. Payne for "Improvements in metal punching machines."

Patent Regulations.—The acceptance of complete specifications delayed under Paragraph 18 B of the Defence of the Realm Regulations will commence in March next, when cases dated 1915 and earlier will be accepted; cases dated after 1915 will be dealt with in April and onwards.

The Patent Office undertakes to supply weekly, as published, all specifications allotted to any particular class or heading. For this purpose a selected list of headings must be supplied, and a deposit account opened.

Notifications and documents relating to foreign patents, designs, and trade marks, which are unable to be forwarded abroad, may now be deposited in the Patent Office (Room 27), with the object of recording the intention of the depositor to do any act or file any document on a certain date at any foreign patent office. No guarantee is given that such procedure will be of advantage to the parties concerned.

Photographic copies of documents, &c., in the Patent Office Library may be obtained at the following rates:—Half-sheet, (13 in. × 9 in.), negative, 1s.; positive, 2s. Whole sheet (13 in. × 18 in.), negative, 2s.; positive, 4s. Applications cannot be accepted which would infringe copyright unless the consent of the owner of the copyright is obtained.

Calendars and Diaries.—Now that the paper restrictions have been to some extent relaxed, we suppose electrical firms will be placing their orders for calendars, diaries and pads. Otherwise, their friends will feel that something is wanting throughout the year. An artistic calendar has been received from the BUFFALO FORGE CO., LTD., Buckingham Gate, Westminster, S.W. The bewitching charms of "Doris" will temporarily pacify us for the lack of other calendars this year.

THE SUN ELECTRICAL CO., LTD., of 118, Charing Cross Road, London, W.C. 2, are unable to send out refills for their desk memo. calendar this year, owing to paper restrictions. Instead thereof, for this occasion they have sent out a very acceptable wall calendar, with small monthly slips beneath, "A World of Beauty," printed in colour. It does not bear their name, a fact which will be quite sufficient to impress upon the recipient's mind from whom it was received.

MESSRS. THERMIT, LTD., of 675, Commercial Road, London, E. 14, have, as in previous years, sent us one of their pocket memoranda books, containing the usual matter relating to their system and calendars for 1919 and 1920.

MESSRS. PIRELLI, of 144, Queen Victoria Street, London, E.C., have produced an excellent wall calendar in their usual form, with a block of daily date slips placed beneath a coloured picture of the Allied Colours being speeded on to success on a Pirelli tire.

We have to thank MESSRS. JOHNSON & PHILLIPS, LTD., Charlton, for a very useful desk blotting-pad and diary, with memo. slips, &c., providing for a variety of wants in a very convenient way.

Munition Plants for Sale.—The Ministry of Munitions is offering for sale a considerable quantity of plant of various descriptions which has been used in the manufacture of munitions but may be useful for ordinary trade purposes; also the national projectile factories at Renfrew, known respectively as "Ypres" and "Aisne."

Turbo-Alternator Contract.—MESSRS. DICK, KERR AND CO., LTD., have recently secured a contract for the supply of a 3,000-KW., 3,000 R.P.M., turbo-alternator set, together with condensing plant, to Messrs. Cammell, Laird & Co., Ltd. The turbine will be of the Willans-Zoelly type, to operate on steam at 160 lb. pressure, superheated to 650° F., and the condensing plant of the surface type, with the Willans rotary system of air extraction, the circulating, ejector, and extraction pumps being driven by an auxiliary turbine which will exhaust into a feed heater. The turbo-alternator, by Messrs. Siemens, will supply three-phase current at 3,300 volts, 50 cycles, and will be fitted with an overhung exciter.

Trade Union Restrictions.—The *Times* Labour Correspondent states that the Bill for redeeming the Government's pledge that Trade Union rules and workshop customs shall be restored, has been drafted by the Ministry of Labour, and will come before the new Parliament at an early date. He says that the Bill, as drafted, requires that employers shall restore the *status quo* as and when required by the Trade Unions concerned, and the Government will presumably be armed with powers to coerce any evasive employer. He adds later that the Unions are disinclined to enter upon discussions or negotiations until the Government pledges are legislatively confirmed. Our readers, however, will remember that Mr. Barnes, in some of his speeches, has advanced proposals for a bargain in which the restrictions are to be sacrificed by the men in exchange for shorter hours and other improvements in conditions. But the men, who are stated to demand legislation before negotiation, have not waited for legislation before they have embarked upon a widespread and growing movement for shorter hours.

Bankruptcy Proceedings.—R. E. CONEOLD, late electrician (now a member of the R.N.A.S.), Canterbury.—Last day for receipt of proofs for dividend January 25th. Trustee, Mr. J. O. Morris, O.R.'s Office, 68A, Castle Street, Canterbury.

ROGER W. WALLACE, barrister-at-law, for many years a director of London electricity supply and other companies, applied for his discharge from bankruptcy on Tuesday last. The Receiver had referred to bankrupt's rash and hazardous speculations. The discharge was suspended for three years.

CHAS. MAYFIELD, electrical engineer, Clifton, Bristol.—Creditor's petition filed, December 18th. Receiving order made January 10th.

Book Notices.—"How to Deal with Different Kinds of Fires." By Sidney G. Gamble, F.S.I., A.M.Inst.C.E. January, 1919. Pp. 50. London: The Committee, 8, Waterloo Place, Pall Mall, S.W. 1. Price 3s. 6d.—Those generally in charge of works and property cannot be expected to have either the necessary experience or knowledge to enable them to handle advantageously, or deal efficiently with, an outbreak of fire, especially if the materials are not the ordinary combustibles. For this reason the British Fire Prevention Committee has issued this "Red Book," No. 201. in the preparation of which it has had the co-operation of Mr. Sidney G. Gamble, late second officer of the London Fire Brigade, who has had a life-long experience of handling fires of every description. The first part of the book gives general information on the subject and the effect of water, steam, chemicals, &c., applied from different forms of fire appliances. Fires of frequent occurrence are dealt with in this part. The second part of the book takes numerous materials and kinds of fire in turn alphabetically from A, alchohol, to Z, zoological collections, including many chemicals, explosives, &c. Useful scientific data have been added, with an appendix on spontaneous combustion, and a list of enactments bearing on the fire question. A limited number of copies can be obtained from the offices of the Committee.

Must we Trade in Tenths? By A. Watkins. Hereford: Watkins Meter Co. Price 3d.—In this brochure the author advocates "octaval," in preference to decimal, coinage. He finds fault with our present coinage, and insists on the merits of binary division, for which he thinks the Anglo-Saxon race has an instinctive affection. The proposed octaval coinage consists of the sovereign, divided into eight half-crowns, which in turn are sub-divided into eight groats (of 3½d. present value), and these again into eight "cents" (⅞d.). Needless to say, a special arithmetic is required to deal with this coinage, as the digits 8 and 9 are not used except for full sovereigns. To pursue the matter further would be to waste space.

"Annual Report of the Director of the Bureau of Standards." Year ended June 30th, 1918. Washington: Government Printing Office.

"Science Abstracts." Sections A and B, Vol. XXI, Part 12. December 31st, 1918. London: E. & F. N. Spon, Ltd. Price 1s. 6d. net each.

No. 3 of the *Crown Journal* has been issued by Messrs. Higgs and Hill, of Crown Works, South Lambeth Road, S.W.; it contains a full account of the extensive public building works activities of the firm—huts, hospitals, aerodromes, gun and searchlight stations—and of the employés' war funds, canteen arrangements, Roll of Honour, &c.

Social.—The employés of the SILUMINITE INSULATOR CO., LTD. spent a pleasant evening at a New Year party. A number of ex-employés of the Southall factory were present, and hearty appreciation was shown of the arrangements made by Mr. Dowton, works manager, and Mrs. Jordan, manageress.

Football.—The match between the Magnet F.C. and Claremont F.C., played at Tulse Hill last Saturday, ended in a victory for the latter by 6 goals to 2. The ground was in a very bad condition.

The Change-Over in Germany.—The Heddernheim Copper & South German Cable Works Co. states that the change over from war to peace work in itself has not been very difficult, as the matter has chiefly concerned the production of semi-finished manufactures for peace purposes instead of for war work, necessitating the output of fine instead of coarse work. The adoption of the 8-hours day would greatly increase the cost of production in the long run. The directors of the Voigt & Haeffner A.G., of Frankfort-on-Main state that although very considerable army orders have been cancelled the transition to peace work has been compelted easily, as an urgent demand prevails for the company's manufactures in connection with central station requirements. This fact applies not only to the home market, but a demand also exists from Holland, Switzerland, and Scandinavia, although this business is said to be endangered through the interference of the Allies with the German export trade.

Enemy Restoration of French Machinery.—The *Daily Telegraph* correspondent at Paris quotes a German wireless as saying that all was ready on Monday in Germany for the delivery of plant, machinery, and implements for the destroyed factories and works in the North and East of France. These include 6,440 electric machines of 117,000 H.P., and 300 other machines, and at the depôt of Bremen 4,500 machines and implements, valued at 20,000,000 marks, of Swiss origin, which can be placed at the disposal of the Entente as compensation. Besides this, there are 400 tons of leather belting, 100 tons of similar textile fabrics, and 60,000 other articles in leather for special industries. All these can be placed immediately in the hands of the Entente Powers. If the situation remains unchanged in Upper Silesia 40,000 tons of zinc can be given over without delay.

Our contemporary quotes General von Winterfeld as saying:—"The German Government declares itself prepared to restore that machinery which was removed from the occupied territory which can be returned forthwith, and also that machinery which was sold to German war industry, the repurchase of which is possible in accordance with agreement with its rightful present owners. The preliminary work for the giving back of that machinery has already been commenced. . . . In all circumstances, refusal must be made to the demand that machines which were carried off shall be replaced by the giving up of machines which are absolutely essential to German industry, for thereby the economic war deprecated by President Wilson would be carried on in another form, and within measurable time Germany would be excluded from the world's markets.

Eight-Hour Day in Iron and Steel Works.—A meeting of employers and workmen from the Midlands, Shropshire, Lancashire, Yorkshire, and Derbyshire was held in Birmingham on Monday to consider the eight hours question. About 85 iron and steel works were represented, and after a long discussion the principle of an eight-hour day was agreed upon, and a committee was appointed to work out details. Work under the new system will begin on the first Monday in February. There will be a re-arrangement of wages.—*Daily Chronicle.*

Non-Ferrous Metal Industry Act.—The issues of the *London Gazette* for January 10th and 14th contain further additions to the list of licences granted under the Act.

Australian Trade Commissioner in London.—Lieut.-Colonel Hurley has been appointed a Trade Commissioner to represent the interests of the State of New South Wales in London.

LIGHTING AND POWER NOTES.

Arbroath.—STREET LIGHTING.—The Lighting Committee has postponed until next season a proposal to light the streets with electricity.

Ardsley.—STREET LIGHTING.—The U.D.C. has invited the Electrical Distribution of Yorkshire to quote terms for lighting the public lamps adjacent to the mains.

Ashton-under-Lyne.—WAGES.—An increase of 5s. per week is to be paid to the employés of the Corporation electricity department, in accordance with the recommendation of the Association of Lancashire and Cheshire Electricity Undertakings.

Athy (Co. Kildare).—PROPOSED E.L.—The U.D.C. has decided to apply for a loan for an electric lighting scheme.

Australia.—SYDNEY.—The E.L. Committee has recommended the City Council to authorise Messrs. Preece, Cardew, Snell & Rider to obtain tenders for boilers, coal and ash handling plant, &c., required at the electricity works; the estimated cost is £85,000.

E.L. SCHEMES.—The residents at Yeronga (Q.) have requested the Stephens Shire Council to distribute electricity within their area. The N. Fremantle (W.A.) Council is obtaining a loan of £4,500 for the distribution of electricity, which is to be obtained in bulk. The Merredin (W.A.) Road Board is inviting applications for the right to install an E.L. scheme in the town of Merredin.—*Tenders.*

Banbridge.—PROPOSED E.L.—The U.D.C. is to consider the question of applying for an E.L. prov. order at its next meeting.

Ballymoney.—PROPOSED E.L.—A company, with a capital of £8,000, has been formed for the purpose of establishing an E.L. scheme in the town, and a site for the power station is under consideration.

Belfast.—MAINS EXTENSIONS.—Subject to satisfactory agreements as to the price to be charged for energy, and to the advice of Sir John Snell, the Electricity Committee has decided to extend the mains to the Montpottinger district.

Bovey Tracey (Devon).—STREET LIGHTING.—The U.D.C. has accepted the offer of the E.L. Co. for public lighting, at £2 10s. per lamp per annum.

Bradford.—PROPOSED NEW PLANT.—The Electricity Committee has recommended that application be made to the L.G.B. for sanction to borrow £295,125 for additional plant at the works at Valley Road and Bolton Road, as follows:—Turbo-generator, complete with condensing plant and auxiliaries; three boilers, fans, chimneys, pipes and boiler-house extension; four forced-draught cooling towers; extensions to suction ash plant; three rotary converters at Bolton Road works; cable-ducts from Bolton Road works to Valley Road works; portable coal elevator.

Dartford.—BATTERY MAINTENANCE.—The U.D.C. has decided not to agree to the increased payment applied for by the Premier Accumulator Co. for the maintenance of the battery at the electricity works.

Douglas (Isle of Man).—PROPOSED E.L.—A proposal before the T.C. to consider the question of purchasing the E.L. plant at the Knocknloe P. of W. Camp for municipal purposes was defeated.

Dublin.—The E.S. Committee has accepted the guarantee of Dublin Shipbuilding, Ltd., North Wall, to take a supply of electricity for a period of 10 years, in accordance with arrangements with the Admiralty. A site for a sub-station at North Wall has been obtained.

LOAN SANCTION.—The Committee has obtained L.G.B. sanction to a loan of £32,000 for extensions and the provision of new plant.

Electric Light in the Arctic.—The *Journal of Electricity* states that Mr. MacMillan and his party of explorers took a marine generating set with them into Crocker Land on their last expedition. It was installed at their lodge, and proved to be a splendid fortification against the six-months-long nights. A head-light over the front door threw its beams 10 miles over the ice, and the electric globes inside were an improvement over the murky gloom of their old stand-by, the blubber lamp.

Glasgow.—PROPOSED EXTENSIONS.—The estimated costs for the erection of new plant and additions to existing plant for the T.C. electricity department are as follows:—Waterloo Street, £15,000; Possilpark, £5,000; Polmadie, £5,000; Linthouse, £4,000; Dennistoun, £3,000; and Springburn, £3,000.

HOSPITAL LIGHTING.—The gas and electricity engineers are to report to the T.C. on a proposal to supply electric light at Belvedere Hospital, in place of gas.

NEW SUB-STATION, &C.—The Electricity Committee has recommended the transference of ground from the tramway department at the Whitevale depôt for the extension of the electricity sub-station, and at the Kinning Park depôt for the erection of a new sub-station; also that the Partick destructor works be transferred from the Cleansing to the Electricity Department.

Gravesend.—PROPOSED EXTENSIONS.—The T.C. has decided to apply to the L.G.B. for sanction to a loan of £23,000, for the provision of a 2,000-KW. generating set at the electricity works.

Haslingden.—YEAR'S WORKING.—There was a gross profit of £1,313 on the working of the Corporation Electricity Department for the year ending March 31st last. The net profit was £100, against £298 in the previous year, and this has been carried to the renewals fund, which now amounts to £991.

Heywood.—PROPOSED LOAN.—The T.C. has decided to apply to the L.G.B. for sanction to a loan of £11,000 for the completion of the bulk supply scheme and the provision of new E.H.T. mains.

Houghton-le-Spring.—STREET LIGHTING.—Owing to the increased charges for gas, the U.D.C. has asked the E.L. Co. to tender for street lighting.

India.—WATER POWER.—The Maharajah of Gwalior has sanctioned an investigation into the Sindh hydro-electric scheme, and a special survey division is being organised, which it is hoped will be in a position to submit the necessary data to the Durbar for approval within six months.—*Indian Engineering.*

Limerick.—PRICE INCREASE.—The Corporation has increased the price of electricity from 8d. to 9d. per unit. The pre-war price was 5d.

Londonderry.—NEW SUB-STATION.—The electrical engineer has reported that, owing to the overloading of the main cables, it will be necessaay to provide a sub-station in the Carlisle Square district.

Liverpool.—In an article on reconstruction problems in Liverpool, Sir Andrew Petrie recommends the construction of a new electric power station at Garston and the extension of the tramway system.

Manchester.—E.L. Failure.—An underground explosion in Albert Street, last Saturday, damaged an electric cable and severed about 600 telephone wires. The electric supply was temporarily cut off in the district.

Wages.—At a meeting of the T.C., last week, Councillor Dagnall, in asking for permission to make a rearrangement in the payment of bonuses to officials of the Electricity Department, remarked that there was a great deal of unrest among the electrical workers of the Corporation, and some officials were leaving for better and more remunerative work elsewhere. The Council agreed to send the question back for further consideration.

Oldham.—Bulk Supply.—The Electricity Committee has decided to quote for a supply of electricity in bulk to Rochdale Corporation.

Proposed Extensions.—At a meeting of the T.C., last week, it was stated that, at its next meeting, the Council would be asked to sanction the borrowing of about £250,000 for the extension of the electricity undertaking.

Peterborough.—Year's Working.—During the year ended March 31st, 1918, 999,541 units were sold by the Corporation electricity department, against 915,142 in the previous year. One-fourth of the output was used for lighting purposes and three-fourths for power. The load factor was 19·05 per cent., compared with 18·99 in the preceding year and about 15 per cent. before the war. The total cost was 2·666d. per unit, including working costs, 1·523d., and capital charges, 1·143d. The financial result was a net loss of £551.

St. Helens.—Proposed Loan.—The T.C. has decided to apply to the L.G.B. for sanction to a loan of £2,000 for the extension of the electricity r ins to the new works of Messrs. Vickers, Ltd.

Stretford.—Loan Sanction.—The T.C. has received L.G.B. sanction to a loan of £26,100 for electricity purposes; £1,125 is for the purchase of a site for a sub-station; £3,500 for the erection of a sub-station; £12,725 for rotary converters and switchgear; and £8,750 for mains.

Swansea.—Price Increase.—The Electricity Committee has increased the charges for electricity by a further 12½ per cent., a total of 25 per cent. over pre-war charges.

Walsall.—Proposed Loan.—The T.C. has decided to apply to the L.G.B. for sanction to a loan of £11,000 for electricity purposes, including transformers and switchgear, £2,322; mains extensions, £5,537; services, £363; and a rotary converter, £2,778.

Watford.—Proposed Loan.—The U.D.C. has decided to apply for a loan of £15,000 for the installation of a 1,250-kw. set.

Whitstable.—Proposed Municipal Control.—The U.D.C. has decided to ascertain whether the Electricity Co. is prepared to dispose of its undertaking to the Council.

Wolverhampton.—Mains Extensions.—Subject to L.G.B. consent to the necessary loan, the electricity mains are to be extended, at a cost of £4,755.

Worthing.—Proposed Loan.—The T.C. has decided to apply to the L.G.B. for sanction to a loan of £16,392 for the extension of the mains and the provision of a Diesel engine and a transformer, and a loan of £7,293 for the extension of the electricity supply to Broadwater.

TRAMWAY AND RAILWAY NOTES.

Argentina.—Strike.—Owing to the general strike, all railway and tramway services have been suspended; several tramcars have been burnt by the strikers.

Belfast.—A Six-day Week.—The Corporation has granted the tramway employés a six-day week, in place of the seven days worked at present.

Blackburn.—Strike.—The strike of tramway employés threatens to spread over the whole of Lancashire. It originated over some employés, who were not members of the Tramway and Vehicle Workers' Union, working on Christmas Day. These men, who belong to a different Union, are still working, and a 50 per cent. service is being maintained. The Colne branch of the Union has voted in favour of a strike. A one-day strike took place at Accrington, consequent on the through-running of the Blackburn cars; the men returned to work on the understanding that no Blackburn cars should run into Accrington until the dispute was settled. The 33 Lancashire and Cheshire branches of the Union have been asked to take a ballot on the question of a general strike, and are said to be generally in favour of a strike. The time-limit fixed by the T.C., in which employés would be reinstated if they returned to work, expired at noon on Monday, but only three men had then returned. The strikers expressed their determination to hold out until it was made a condition of employment with the tramway department that the men should join the Union.

Blackpool.—Tramway Purchase.—The Bill promoted by the Corporation for the purchase of the undertaking of the Blackpool and Fleetwood Tramroad Co. contains proposals for linking-up the system with that of the Corporation, at an estimated cost of £15,000. The total price is £284,000, including £4,000 compensation to the directors as five years' fees, and £10,000 to Mr. John Cameron, the secretary and manager of the company. The sale took effect from January 1st last, but the company is carrying on until Parliamentary sanction to the transfer is received.

Bradford.—New Tramcars.—The Tramways Committee has given authority for a trial car to be built, 6 in. less in height than the present cars.

Track Renewals.—The Tramways Committee proposes to inform the L.G.B. that the relaying and doubling of the tramway track from Tyrrel Street to Listerhills Road is urgently necessary.

Brazil.—Proposed Electric Railway.—The Chamber of Deputies is considering a petition for a concession to construct an electric railway from Cascalheira to Oyapock.—*Financier.*

Chile.—Strike.—Men employed by the Chilean Electric Tramway Co. at Santiago are still on strike. General labour unrest is evident throughout Chile.—*The Times.*

Continental.—Italy.—The Società Elettrica Bresciana proposes to increase its capital from 25,000,000 lire to 34,000,000 lire for the purpose of extending its electric railway network in the Province of Brescia.

France.—Owing to the River Seine overflowing and flooding the streets, the tramway service in several districts of Paris had to be suspended last week.

Cumberland.—Proposed New Railway.—It is proposed to construct a railway along the Cumberland coast, from Silloth to Maryport.

Glasgow.—Goods Traffic.—The Tramways Committee has inaugurated a parcel service on the Glasgow-Uddingston route.

Gloucester.—Wages.—The T.C. has increased the war bonus of technical assistants employed by the tramway department to 28s. 6d. per week, and of all other employés from 18s. to 24s.

Grimsby.—Strike.—The strike at the municipal electricity works came to an end on Monday, last week, and the naval contingent, which had maintained the supply, was withdrawn. The new agreement is for a 47-hour week, with one break daily for meals.

Haslingden.—Year's Working.—For the year ended March 31st last, the gross profit of the Corporation tramway department was £2,386, against £933 in the previous year.

Leeds.—Goods Traffic.—The facilities on the Corporation tramway parcel delivery system have been extended, and a through service has been established between Leeds, Bradford, Halifax, and the heavy woollen district.

Accident.—Tramway traffic was greatly disorganised by fog on Monday. An unknown man was knocked down and killed by a tramcar.

Lincoln.—Surface-Contact System.—Owing to the burning out of an underground cable, part of the Corporation surface-contact tramway system became electrified on January 6th. Several persons had narrow escapes, and a horse was killed before the pressure could be cut off.

London.—Central London Railway.—The B. of T. has extended the time for the completion of the enlargement of the tunnels and for the exercise of certain financial powers authorised by the C.L.R. Act, 1914, by one year from July 8th, 1919.

Threatened Strike.—Owing to the refusal of the Railway Executive Committee to extend to them the 47-hour week granted to the railway, the workers at the Chelsea power station threatened to strike at 5 p.m. on January 9th, but on the chairman of the Committee (Sir Herbert Walker) agreeing to meet the representatives of the E.T.U. on the 13th inst., the strike notice was withdrawn. The strike would have affected all the London tube railways, with the exception of the Central London.

At a conference on Monday between the E.T.U. and the Railway Executive Committee, it was agreed to establish a 47-hour working week for day workers on all railways as from January 1st, and a 48-hour working week in all generating and sub-stations in the United Kingdom, to come into operation on February 1st. Wages are to be adjusted on existing rates.

Manchester.—New Tramcars.—The Tramways Committee has commenced the construction of 100 new tramcars.

Musselburgh.—Proposed Extension.—A scheme is on foot for the extension of the tramway system to Tranent.

Newcastle-on-Tyne.—Accident.—Traffic was much impeded by dense fog on Monday; a merchant's trolley was run into by a tramcar and cut completely in halves. The driver and horse of the trolley were injured, but not seriously.

South Shields.—Proposed Extensions.—The Tramway Committee proposes to proceed with an extension scheme sanctioned in 1915, and the sanction of the Treasury to the necessary loan is being sought.

Stockton.—Proposed Extensions.—The R.D.C. has decided to oppose the Bills of the Stockton and Middlesbrough Corporations to construct tramways in the parish of Billingham.

Southport.—YEAR'S WORKING.—The report of the Corporation tramway department for the year ended March last, shows receipts of £32,582, including £4,513 from three months' running of the Southport Tramway Co.'s undertaking, which has now been acquired by the Corporation. On its own system the receipts showed an increase of £3,310, and constituted a record. The gross profit of £10,263 was the highest ever reached; but after paying the whole of the capital charges, there was a net loss of £103. The total car-mileage was 573,998. Passengers carried on the Corporation system increased from 5,020,088 to 5,808,960, and 520,492 units were used, or '927 per car-mile.

TELEGRAPH AND TELEPHONE NOTES.

A Police Wireless Installation.—The *T. and T. Age* gives an outline of the work done by the wireless telegraph branch of the New York Police Department. It shows that merchandise estimated to be worth $400,000 and at least 25 lives have been saved, in the two years the department has been in operation. The wireless tower is on the roof of the police headquarters, and the sea-going end on board the police boat *Patrol*, which covers the harbour. Two thousand messages have been handled, the headquarters being able to receive messages from a distance of 1,500 miles, and to transmit them 300 miles.

Automatic Telephones.—An automatic exchange is to be opened shortly at Stockport. This will be the twelfth in the Provinces since the first, at Epsom, the nearest to London, was opened in May, 1912.

New London Exchanges.—According to the daily Press, several new telephone exchanges are to be opened shortly in London, several of which will be automatic exchanges.

Snowstorms.—During the snowstorm at the beginning of last week the telephone exchange at Hipperholme caught fire owing to broken wires coming into contact with overhead tramway wires.

A detachment of R.E.'s helped to repair the broken telephone and telegraph wires at Manchester.

Owing to the heavy fall of snow and consequent breakdown of the block telegraph wires in Lancashire, Yorkshire, and Derbyshire, there was considerable delay to passenger trains.

United States.—The Federal Court dismissed the suit by the Commercial Cable and Commercial Pacific Cable Companies to restrain the United States Postmaster-General (Mr. Burleson) from taking over the cables, on the ground that it had no jurisdiction in the matter.—*Financier.*

CONTRACTS OPEN AND CLOSED.

OPEN.

Aberdeen.—Corporation Electricity Department. Five-ton tipping wagon for coals. Electric vehicle preferred, but not essential. See "Official Notices" January 10th.

Australia.—SYDNEY.—April 28th. City Council. Supply and erection of power-house switchgear. Specifications from Electric Lighting Department, Town Hall, Sydney. A copy can be seen at the Inquiry Office of the Department of Overseas Trade (Development & Intelligence), London.

MELBOURNE.—March 10th. City Council. One 5,000-KW. frequency changer, high-tension switchgear. Specification (£1 1s.) from City Electrical Engineer.

Aylesbury.—B.C. 200 to 400-KW. internal-combustion engine and dynamo complete. See "Official Notices" to-day.

Belfast.—February 24th. Electricity Department. One 50-ton overhead travelling crane, one 5-ton overhead hand crane, and two 3-ton travelling electric cranes; two 24-in., one 5-in. and one 3-in. electrically-driven centrifugal pumps; five cast-iron water storage tanks.

Halifax.—The Electricity Committee has instructed the Electrical Engineer to obtain quotations for the supply of a coal conveyor.

Hammersmith.—B.C. The Electricity Committee reports that Messrs. Cory Bros. & Co., Ltd., the coal contractors, notify that owing to the increase in the cost of lighterage, their prices will be advanced all round 3d. per ton from December 1st, bringing the total cost of coal as follows: Hucknall 27s. 10½d. per ton; G.T.H. peas 30s. 2½d.; G.H.H. slack 25s. 2½d.; Abercwyd 30s. 3½d.; G.H.H. peas 31s. 2½d.

The Committee reports that on the question of the diversion of coal supplies the Coal Controller states that the necessity for the diversion arose out of the national emergency, which left the Department no alternative but to suspend deliveries to those undertakings more favourably placed, to assist in maintaining in the public interest the continuation of the requisite light and power in the districts affected, and it was anticipated that any inconvenience or additional expense thereby caused to those undertakings and Corporations who were in a position to render this assistance, would be accepted as inseparable from the gravity of the national situation.

Leeds.—The Tramways Committee has been authorised to accept a tender for a negative booster for the Crown Point generating station, at a cost not exceeding £2,600.

Sheffield.—Corporation Water Department. Two 3-ton steam locomotive cranes and one 5-ton electric locomotive crane, D.C., 460/500 volts. See "Official Notices" January 10th.

Spain.—The municipal authorities of Bunol (Province of Valencia) have lately invited tenders for the concession for the electric lighting of the town during a period of five years.

Uxbridge.—January 21st. U.D.C. 25-H.P. A.C. motor for the sewerage works. Mr. W. T. Harvey, Clerk, 63, High Street, Uxbridge.

Warrington.—January 28th. Electricity and Tramways Committee. One 300-KW. and one 500-KW. rotary converter. See "Official Notices" January 10th.

CLOSED.

Battersea.—B.C. The Electricity Committee recommends that the price of coal supplied by the contractors, Messrs. Rose, Smith & Co. and Messrs. Foster & Co., be further increased by 3d. per ton, in consequence of the increased wages granted to dock workers, &c., by the Committee of Production.

E.H.T. switchgear, £420. General Electric Co., Ltd. (accepted).

Bradford.—Electricity Committee. Accepted:—

Steelwork for air filter house.—Redpath, Brown & Co., Ltd.
Switchgear.—A. Reyrolle & Co., Ltd; Bertram Thomas.
Battery booster set.—Mather & Platt, Ltd.
Building transformer chamber.—T. Obank & Sons.

Tramways Committee. Accepted:—

Three Venturi water meters.—G. Kent, Ltd.
Cast and steel crossings.—Hadfields, Ltd.
Copper rail bonds.—Britannia Lamp & Accessories Co., Ltd.
Rail planer blades.—Taylor & Parsons.

Gillingham (Kent).—T.C. Charging plant for electric dust carts:—

General Electric Co., Ltd.—A.C. and D.C. control gear or separate panels (accepted), £409.
British Thomson-Houston Co., Ltd.—Ditto or one panel, £983.

Heywood.—The Corporation has accepted the tender of the Rail Welding Co., London, for the repair of 230 rail joints on the tramway system. The work will cost about £1,000.

Southport.—The Tramways Committee has recommended the acceptance of 18 standard 4-wheel trucks, at £180 each, 24 30-H.P. car motors, at £165 each, and three open toast-rack car bodies, at £480 each.

Swansea.—The Corporation Electricity Committee has accepted the tender of the Stirling Boiler Co., for two water-tube boilers, price £22,440. The pre-war cost it was stated would have been about £10,000. The tender provides for the removal of the present four old Lancashire boilers.

Wolverhampton.—T.C.:—

Two 333-K.V.A. transformers, £839, plus £81 for contingencies.—British Electric Transformer Co.
Stanchions for carrying boiler flues, £69.—Gibbons Bros.
Gangways, ladders and railways, for the new boiler house, £114.—Hebertson & Co.

FORTHCOMING EVENTS.

Royal Institution of Great Britain.—Friday, January 17th. At 5.30 p.m. At Albemarle Street, W. Lecture on "Liquid Air and the War," by Prof. Sir Jas. Dewar, F.R.S.

Junior Institution of Engineers.—Friday, January 17th. At 39, Victoria Street, S.W. At 7.30 p.m. Paper on "Recent Improvements in Electric Lamps," by Capt. R. S. Mullard, R.A.F.

(North-Eastern Section).—Tuesday, January 21st. At the Mining Institute, Newcastle. At 7.15 p.m. Paper on "Design of Heavy Switchgear," by Mr. F. A. Orchard.

Illuminating Engineering Society.—Tuesday, January 21st. At the Royal Society of Arts, John Street, Adelphi. At 8 p.m. Discussion on "Modern Practice in Office Lighting," to be opened by Mr. A. Wise.

Industrial Reconstruction Council.—Wednesday, January 22nd. At the Saddlers' Hall, Cheapside, E.C. At 4.30 p.m. Lecture on "Industrial Reconstruction in Government Departments," by his Honour Judge Edward Parry.

Institution of Electrical Engineers.—Thursday, January 23rd. At the Institution of Civil Engineers, Gt. George Street, S.W. At 6 p.m. Lecture on "Planning a Works Research Organisation," by Mr. A. P. M. Fleming, O.B.E.

(Students' Section).—Friday, January 24th. At 7 p.m. At the Northampton Polytechnic Institute, Clerkenwell, E.C. Paper on "A General Outline of Telephony," by Mr. H. T. Body.

Institution of Mechanical Engineers.—Friday, January 24th. At 6 p.m. At the Institution of Civil Engineers, Gt. George Street, S.W. Paper on "Electric Welding," by Mr. J. T. Heaton, and other papers on oxy-acetylene welding.

Greenock Association of Electrical Engineers.—Saturday, January 25th. Visit to Messrs. A. F. Craig & Co.'s Engineering Works, Paisley.

Manchester Association of Engineers.—Saturday, January 25th. At 6.30 p.m. At the Grand Hotel. Discussion on "The Past, Present and Future of Electricity Supply," to be introduced by Mr. S. L. Pearce.

THE ELECTRICAL TRADES BENEVOLENT ASSOCIATION.

THE following is a first list of contributions for amounts of 10s. and over received in response to the appeal made on behalf of this Institution by Mr. Hunter, the Chairman :—

	£	s.	d.
East London Rubber Co.	1	1	0
Arthur H. Allen		10	0
C. Franklin Tubbs ...	1	1	0
V. Delebecque	1	1	0
Fred. Crane Chemical Co., Ltd.	1	1	0
Christy Bros. & Co., Ltd.	1	1	0
W. Lawson		10	0
W. N. Warrilow	1	1	0
E. S. Byng	10	10	0
T. W. Smith		10	0
A. W. Kimber	10	0	0
Handcock, Dykes and Trotter	1	1	0
W. H. Willcox & Co., Ltd.	3	3	0
W. Sisson & Co., Ltd. ..	1	1	0
A. E. Gott	1	1	0
F. W. Parks	1	1	0
Reynolds & Bradwell ...	2	2	0
Guy Burney	2	2	0
S. D. White	5	5	0
Theodore Settle	2	0	0
Lawton & Sons	1	1	0
V. G. Middleton	1	1	0
W. H. Patchell	1	0	0
F. Atkins	1	1	0
H. Snowdon	1	1	0
G. T. Baxter		10	6
J. S. Child	2	2	0
L. Vandervelde	2	2	0
Chiswell & Co.	1	1	0
O. H. Bishop	1	1	0
H. G. Trust	1	0	0
C. J. Phillips	1	0	0
Carless, Capel & Leonard	1	1	0
Metropolitan Rly. (General Manager's Office, Baker St. Station) ...	2	2	0
T. P. Shilston, B.Sc. ...	1	0	0
John Ashby	1	1	0
R. Paul	10	0	0
H. P. Girling, M.I.E.E.	1	1	0
Carter & Harrison ...	1	1	0
B. H. Jenkinson	2	2	0
Selson Eng. Co., Ltd. ...	2	2	0
Farrow & Jackson, Ltd.		10	0
C. E. Foster		10	6
Economic Elec. Co. (T. E. Jones)	1	1	0
Benjamin Elec. Co., Ltd.	10	10	0
R. P. Wilson	5	0	0
W. H. Fletcher	2	2	0
The London Elec. Firm	2	2	0
T. J. Digby	2	2	0
C. Langdon & Son ...		10	6
E. Dixon	1	1	0
G. Braulik	1	1	0
D. Shanks & Co., Ltd. ...	2	0	0
Cressall Mnfg. Co.	5	5	0
Kaleb Hendin	1	0	0
R. J. Natlin	1	0	0
Simplex Conduits, Ltd.	2	2	0
American Hard Rubber Co.	2	2	0
A. R. Tudman	1	1	0
J. W. Jachman & Co., Ltd.	2	2	0
H. White & Co.	1	1	0
Barlow & Alden, Ltd. ...	1	0	0
J. H. Fonsil	1	0	0
Lacy, Hulbert & Co. ...	2	2	0
A. J. Wright, Ltd. ...	2	2	0
E. Mathews & Co.	2	2	0
Basebe, Sadler & Co., Ltd.	1	1	0
W. E. Bradshaw		10	0
F. Chase	1	1	0
Baugham & Co., Ltd. ...		10	6
T. Francis & Son		10	0
H. Marryat	10	0	0
Cramner & Cheshire ...	1	1	0
J. W. Yalesley	1	1	0
T. Ludgate	1	1	0
Ouram-Robertson Lamp Works	21	0	0
W. Canning & Co. ...	1	1	0
J. Macintyre & Co., Ltd.	3	3	0
L.P.S. Electrical Co. ...	1	1	0
A. Hawkins & Sons ...	1	0	0
A. West & Partners ...	1	1	0
Dubilier Condenser Co., Ltd.	10	0	0
Rouch & Penny	1	1	0
Gilbert Carpenter	1	1	0
F. Smith & Co. (Manchester)	2	2	0
Cunningham, Ltd.	1	1	0
E. B. Ellice Clark ...	10	10	0
R. Wilson Smith	1	1	0
E. G. Byng	10	10	0
L. G. Byng (Exors. of late)	100	0	0
F. A. Hill & Co.	2	2	0
Jackson & Boyce	1	1	0
W. O. Rtoper	1	1	0
A. Graham & Co.	10	10	0
Mrs. H. Ayrton	2	0	0
W. J. P. Orton	1	0	0
M. Deacon, J.P.	5	0	0
A. Seward & Co., Ltd. ...	1	0	0
J. R. Hewitson		10	0
Walsall Hardware Mnfg. Co.	5	5	0
Phœnix Electric Co. ...	3	3	0
Smith & Croft	2	2	0
T. W. Lench, Ltd. ...	2	2	0
F. A. B. Lord	3	3	0
G. E. Hood	2	2	0
L. Hurburgh	1	1	0
Pope's Elec. Lamp Co., Ltd.	1	1	0
T. S. Watney	2	2	0
J. J. Roche & Co.	1	1	0
Julius Sax & Co., Ltd. ...	1	1	0
G. Stephen Corlett	1	1	0
H. McDarrah	1	1	0
Neil McLean		10	6
Elec. & General Works, Ltd.	1	1	0
Norman Dickson, Pringle and Co.	1	1	0
Wholesale Fittings Co., Ltd.	2	2	0
Dussek Bitumen Co. ...	1	1	0
Eustace Thomas	1	1	0
H. W. Smith & Co. ...	10	0	0
T. Wardrobe	1	1	0
H. W. Kefford	1	1	0
Fuller Electric & Mnfg. Co.	2	2	0
D. Assersohn	1	1	0
Dowsett & Jenkins, Ltd.	1	1	0
J. C. Gilkes		10	0
J. Findlay	1	1	0
E. C. de Segundo	1	1	0
H. G. Solomon	1	1	0
Caskell & Grocott	1	1	0
Calmont, King & Co. ...	2	2	0
Locke Lancaster and W. W. & R. Johnson and Sons, Ltd.	2	2	0
J. M. Doughty	1	1	0
Duram, Ltd.	10	10	0
Hugh Mountain	2	0	0
J. H. Heathman		10	0
J. Scrivener	1	1	0
W. Frain	10	10	0
Alex. Laurie & Co.	5	5	0
David Kirkaldy & Son ...	1	1	0
British Ever-Ready Co. ..	5	5	0
Major Wm. Parker ...	1	1	0
Pearson Bros.	1	1	0
S. Wolf & Co., Ltd. ...	1	1	0
W. M. D. Pell	2	2	0
Best & Lloyd	10	0	0
Oliver Pell Elec. Mnfg. Co., Ltd.	2	2	0
J. A. Ritchie	1	1	0

SHORTER WORKING WEEK FOR EMPLOYÉS IN ELECTRICITY UNDERTAKINGS.

WE have received from Mr. W. J. Webb, London District Secretary of the Electrical Trades Union, a copy of an agreement between the electricity undertakings of London on the one hand, and the Electrical Trades Union, the National Union of General Workers, the Workers' Union, and the National Amalgamated Union of Enginemen, Firemen, Mechanics, Motormen, and Electrical Workers on the other, in respect of a shorter working week for men employed in electricity undertakings. We have also received a copy of the agreed rates for a 47-hour week for day workers. In the case of shift workers, the rates to be paid are on a 56/48 basis. Practically the same agreement has been come to in respect of the railways in the United Kingdom, except that the 47-hour week for day workers started on January 1st. The following are the agreements referred to :—

Re ELECTRICITY UNDERTAKINGS (GENERAL), LONDON DISTRICT.

Claim by four Unions for 47-hour week without reduction in pay.

MEETING BETWEEN EMPLOYER AND UNION REPRESENTATIVES. AWARD 2,772, PARAGRAPH 13.

Matters arising out of Meetings held on December 30th and January 2nd, 1919, at the County Hall.

The Employer and Union Representatives are willing to accept an Award of the Court of Arbitration embodying the following :—

1. 47-hour week in the case of day workers.

2. 48-hour week in the case of shift workers, subject to—

(*a*) The 48 hours being an "average" week's work where mutually agreed upon between the employers and employés of individual undertakings. In any case where details cannot be agreed the matter should be referred to a joint meeting of the employers and Union representatives (Award 2,772, Paragraph 13).

(*b*) Shift workers to interchange occupation according to shift relief.

(*c*) In the event of any undertaking not being able to put the shorter hours into operation on February 1st, 1919, through shortage of labour, the Unions will remove any restriction on their members working a longer week at normal rates up to 56 hours, or such week as at present worked, until such time as the undertaking can obtain the necessary qualified men, but the Unions desire to restrict such time to March 1st.

If sufficient qualified men are not available by March 1st, the matter to be again considered by the joint meeting of the employer and Union representatives (Award 2,772, Paragraph 13).

3. *Date for Commencement of the New System.*—Hours, rates, and conditions remaining as per Award 2,772 until —day workers, 47-hour week from February 1st, 1919; shift workers, 48-hour week from February 1st, 1919.

4. *Basic Rates. Award* 2,772, *Paragraph* 8.—Hourly rates under this heading to be adjusted from February 1st, 1919, as under :—

Day workers in ratio of 54 : 47.
Shift workers in ratio of 56 : 48.

A sub-committee of two on either side to revise these hourly rates for submission at an early date to the Joint Meeting of Employer and Union Representatives (Award 2,772, Paragraph 13).

AGREED RATES.

Grade.	Award 2772 rate.	Decimal rate. 54 : 47.	Agreed rate.
Fitter	0s. 10½d.	12.06	1s. 0d.
Jointer	0s. 9½d.	10.91	0s. 11d.
Plumber jointer	1s. 0d.	13.78	1s. 1½d.
Armature winder	0s. 10½d.	12.08	1s. 0d.
Cable ganger	0s. 10d.	11.48	0s. 11½d.
Public lighting foreman ...	0s. 10d.	11.48	0s. 11½d.
Public lighting leading hand	0s. 9½d.	10.91	0s. 11d.
Public lighting attendant ...	0s. 8d.	9.19	9.2
Arc lamp trimmer	0s. 8½d.	9.76	0s. 9½d.
Meter inspector and tester ...	0s. 10½d.	12.06	1s. 0d.
Meter repairer	0s. 11d	12.83	1s. 0½d.
Meter fixer	0s. 8½d.	9.76	0s. 9½d.
Meter reader	0s. 8d.	9.19	9.2
Overhead linesman	0s. 9½d.	10.91	0s. 11d.
Assistant storekeeper ...	0s. 8d.	9.19	9.2
Battery fitter	0s. 10½d.	12.06	1s. 0d.
Battery attendant	0s. 9d.	10.34	0s. 10½d.
Conduit system :			
Leading hand	0s. 8½d.	9.76	0s. 9½d.
Cable hand	0s. 7½d.	8.61	8.6
Fitter's mate			
Wireman's mate			
Electricinn's mate	0s. 8d.	9.19	9.2
Jointer's mate			
Telephone electrician ...	0s. 10½d.	12.06	1s. 0d.
Telephone linesman ...	0s. 9½d.	10.91	0s. 11d.
Boiler cleaner	0s. 8½d.	9.76	0s. 9½d.
Labourer, indoor	0s. 7d.	8.04	0s. 8d.
Labourer, outdoor	0s. 7½d.	8.61	8.6
Cleaner	0s. 7d.	8.04	0s. 8d.
Ash hopper & conveyer man ..	0s. 8½d.	9.76	0s. 9½d.
Coal handling			
Coal weigher	0s. 8d.	9.19	9.2
Shunters and tippers ...			

The Channel Tunnel.—According to the daily Press, Sir Francis Dent, general manager of the South-Eastern and Chatham Railway, strongly supported a Channel tunnel as opposed to a train ferry before the Select Committee on Transport. The highest estimate, he is reported to have said, of the cost of the tunnel was 25 millions, and the working of the tunnel by electricity would be "extraordinarily cheap." He did not think the train ferry "a business proposition." It would not compete with a direct steamer in carrying perishable goods, nor could it carry anything like the proportion of passengers and quantities of goods carried by the present passenger boats. He was quite satisfied that the service could not be developed commercially nor could anything like the speed be attained.

"ELECTRICAL REVIEW" SMALL ADVERTISEMENTS: EARLIER CLOSING TIME.

Special attention is directed to the alteration in the time for receipt of small advertisements for the Electrical Review. Owing to the great increase in their number, and to enable the journal to be produced punctually to time, copy for such advertisements must be received here by 5 p.m. on Wednesday, instead of on Thursday morning, as hitherto. This notice relates to Official Notices, Patent Notices, Situations Vacant, Situations Wanted, Partnerships, Agencies, Articles for Sale, Articles Wanted, &c.

NOTES.

Volunteer Notes.—Royal Engineers Volunteers, London Army Troops Companies.—Headquarters: Balderton Street, Oxford Street, W. 1.

Regimental Orders No. 3, by Lieut.-Colonel C. B. Clay, V.D., Commanding.
Monday, January 20th, to Saturday, January 25th, drills as usual.

C. Higgins, Captain, R.E., *Adjutant.*

Nationalisation of Railways.—The Prime Minister is reported to have stated that the plans of the Government for the future control of the railways will be among the first measures to come before the new Parliament.

Gift to Promote Industrial Unity.—According to a statement made by Mr. G. N. Barnes, M.P., at a dinner of the Industrial League, Sir Wm. Dupree, of Portsmouth, has given £20,000 to the funds of the League, in recognition of the importance of its work in encouraging co-operation between employers and employed.

Institution and Lecture Notes.—Irish Water Power.—Mr. J. Challoner Smith, in a paper read at the Institution of Civil Engineers in Ireland, on the question of Ireland's water power, said that the fluctuations in the volumes of the flows rendered it extremely unlikely that the large continuous powers necessary for great electrometallurgical or kindred plants could be obtained within the limits of reasonable outlay. Many sites existed, however, at which useful powers for lighting, milling, &c., might be provided, under skilful design and supervision.

Electric Steel Furnaces.—Mr. H. Etchells, of Sheffield, read a paper on "The Function of the Electric Furnace in Modern Engineering Practice," before the members of the Birmingham Metallurgical Society, on Thursday, last week. In order to appreciate the fuel efficiency of the electric furnace at its true significance, he said, one must not think only in terms of the number of electrical units per ton of metal melted or heat-treated, but this should be resolved actually into terms of the weight and quality of fuel put into the fire-grate at the generating station. When electric power was generated with 30 per cent. efficiency at the generating station, electric furnaces would compete as regarded fuel cost with other types. Mr. Etchells insisted that the electric furnace had revolutionised the science of casting. Midland manufacturers could now be assured that homogeneous, unsegregated castings, free from blow holes, could be produced in sizes varying from a few ounces up to several tons, and this would tend to cheaper production in all directions and eliminate expensive forging and pressing operations.

Fuel Economy and Health.—On January 6th, Mr. A. H. Barker opened a course of Chadwick Trust lectures on "Fuel Economy and Health," at the Royal Society of Arts. Dealing with the heat requirements of a human body, he estimated the average requirements for the well-to-do person in conditions of life similar to those prevailing at the present day as about two tons of fuel per annum, and for the poorer classes about three-quarters of a ton per annum; these quantities could not be reduced otherwise than by improving the efficiency of the plant commonly employed. To calculate the requirements of temperature and humidity in the surrounding air suitable for so changeable a mechanism as the body, was impossible, and the matter could only be treated empirically. Mr. Barker described in detail recent American experiments to determine the most suitable conditions from the point of view of comfort, and concluded that the four desirable elements of fresh air were freedom from dust and germs, from undue elevation of temperature and humidity, and from undue uniformity and stillness.

The second lecture related to the heat requirements of a house. Mr. Barker compared the different methods of warming a building, and discussed their advantages and disadvantages from the user's point of view. A radiator method of warming, he said, used only about one-quarter of the fuel required by an open fire for equal heating effect. He next discussed the appliances used for generating heat for heating, cooking, and hot-water supply, and pointed out the features which led to extravagance and economy. He stated that whereas the present domestic requirements of the entire nation required the consumption of 30 million tons of fuel per annum, the same requirements could be served by the most economical modern appliances, used in a most careful manner, by a consumption of approximately 6,000,000 tons.

The last lecture of this course will be given on Monday next.

Educational.—Loughborough Technical College.—Under the direction of the Principal (Mr. H. Schofield, M.B.E.), an Instructional Factory has been built and equipped at Loughborough for the training of semi-skilled munition workers, under the control of the Ministry of Munitions. Now that the war has come to an end, the Committee thinks that it is most desirable that the organisation and equipment should be retained in their entirety as a national institution for engineering training. With this object in view a memorandum has been prepared, showing exactly how the resources of the Loughborough College might be best utilised.

The factory forms part of the parent institution, and is operated under the Principal as general manager, with the co-operation of a works manager and works superintendent, all of whom have had a wide experience of practical engineering and scientific training. The works are run on productive lines, and at present give occupation to some 500 trainees; actual engineering contract work is accepted, and carried through from the estimating department to the inspection department. The equipment of the works is complete in all respects, with up-to-date tools and appliances. The memorandum gives full particulars of the training courses, equipment, &c.

Electric Power Supply and the War.—In a letter to municipal and private electricity undertakings, Mr. Winston Churchill says:—

"Now that the war has been won, it is my pleasant duty, as Minister of Munitions, to testify to the part that has been taken by all those who have been responsible for electric power supply throughout the war.

"The over-riding needs of the British Armies have required the output of war material on an unprecedented scale, and in every class of supply the demand has been met. But this achievement would have been impossible without the effective and ungrudging co-operation of the principal electrical undertakings of the country. The demands made upon you have been exacting, and I recognise to the full the increasing difficulties that you have been called upon to surmount in maintaining and augmenting the supply of electric power on which the great industrial centres have depended.

"I therefore desire to convey to you, and through you to all members of your staff, my sincere thanks for the valuable services you have rendered to the Ministry of Munitions."

The justice of this official tribute to the wonderful work done by our electric supply undertakings will be acknowledged by all who are aware of the extraordinary efforts that have been put forth by the managers and staffs, and the strenuous conditions under which their work has been carried on—conditions which would have been regarded in peace-time as unthinkable. We have on several occasions directed attention to the excellent record of the central station engineers in war-time, and we are glad to know that it is recognised in official quarters.

Fatalities.—"Accidental death" was the verdict returned at the inquest concerning J. Lindley (28), woollen spinner, who died from electric shock received in the hoist-cage at Lockwood Mills, Huddersfield. The evidence showed that he was attempting to open the hoist-gate by depressing the catch, and the gate had become electrified by the displacement of the lock, through which a 400-volt current was transmitted.

At the inquest into the death of Mrs. Rhoda Macnamara (23), of Oldham, killed by falling 24 ft. while oiling an electric crane at the Middleton Road goods yard of the L. & Y. Railway, the Coroner said it was questionable whether such dangerous work was suitable for a woman, and he suggested the taking of measures for more effective protection.

At an inquest at Hyde, last week, on Frank Potts (26), a miner, who met his death suddenly at Kingston Colliery, Hyde, on December 28th, it was stated that a bell wire for signalling ran just under the electric cable. While holding the bell wire he apparently received a fatal electric shock. It was stated that the signal wire was now being transferred to the opposite side of the brow, so as to avoid the possibility of contact. Verdict, "Accidental death."

Several boys were playing with a fallen telephone wire that crossed over electric cables behind the Turbine Gear Engineering Works, near the Joint Electricity Board's sub-generating station at Hyde, on Monday, when they felt electric shocks. All the lads at once let go of the wire except Ernest Wimpenny (10), son of a collier, who stuck and cried out. The other boys ran and told his parents, and shortly afterwards he was found dead.

Concert.—The Electrical Trades Benevolent Institution last year inaugurated the system of Local Advisory Committees, and appointed on the Management Committee gentlemen in different provincial towns in order that these Local Advisory Committees might be got to work. In Cardiff, Mr. Hobbs, of the General Electric Co., Ltd., who has for many years supported the Institution, was duly elected on the Management Committee, and formed a Local Advisory Committee, which includes:—Mr. W. A. Chamen (South Wales Power Co.), Mr. R. Howard Fletcher (consulting engineer), Mr. A. C. MacWhirter (MacWhirter & Sons, Ltd.), and Mr. J. P. MacTaggart (Siemens Bros. & Co.). These gentlemen organised a concert, and secured the services of the Royal Breconia Glee Singers, who on Saturday, January 11th, gave an excellent concert at the Whitehall Room, Cardiff, to a crowded house. With subscriptions and the result of the concert, practically 100 guineas will go to the Institution. We wish the Institution every success in its new policy, and trust that the example of Mr. Hobbs will be followed in other centres, so that not only will the Institution have the advantage of the increased income resulting from their energies, but it will also get into closer touch with those members of the industry who require the assistance of the Institution. Local Committees will probably get to work at Birmingham, Bristol, and Glasgow ere long.

Fuel Economy.—The Electricity (Restriction of New Supply) Order has been revoked as from January 10th.

Appointments Vacant.—Assistant engineer, for the Singapore Electric Tramways, Ltd. ($450 per month), application to company's office in London; junior assistant engineer, also wireman, for the Burnley Corporation Electricity Department; assistant electrical engineer (£360 + £75), for the Federated Malay States; assistant instructors in electrical engineering and installation maintenance and repair work for the Ministry of Pensions Training Scheme at the Croydon Polytechnic; draughtsman for the Battersea B.C. Electricity Works; chief engineer for a South Coast generating station. See our advertisement pages to-day.

Supply Station Engineers' Salaries.—At a meeting between the Standing Conference and the E.P.E.A., on the 8th inst., the following recommendation was agreed upon:—

We, the Standing Conference of Electricity Supply Associations, recommend the constituent associations to agree to an award of Court of Arbitration to pay as from March 31st, 1918, to technical engineers on the staffs of the undertakings from and including the grade of junior charge engineers to and including the deputy chief officials (that is to say, excluding all the grades for which basis rates were settled by the award (2,772) Electrical Undertakings (General) London District) the salary paid at July 31st, 1914, plus merit and grade increases between that date and March 31st, 1918, plus 20 per cent., plus an additional sum at the rate of £90 per annum, war advances and war bonuses to be merged in the above.

This arrangement to be operative until March 31st, 1919, or such other date as may be mutually agreed, and in the meantime the Conference and the E.P.E.A. to meet and proceed to settle basic rates of remuneration for the various grades as above, pending which sectional discussions as to basic rates shall be adjourned. We understand that application has been made to the Ministry of Labour for the issue of an award in the terms of the above recommendation.

Women as Engineers.—One of the pressing problems of the demobilisation of munition workers is the finding work for the junior administrative staffs and the educated forewomen who were in special demand during the war, and whose salaries averaged about £4 a week. The present demand for skilled and unskilled women in civil industries is mainly in domestic work and in laundries, and cannot reach the class above referred to. It would appear that they are, though a smaller section, likely to be more difficult to suit than other workers. Many educated women who took up engineering to make munitions are also wondering what they will be able to do in the future. They desire to stay in this kind of work, to which they have become accustomed, but so far there is no scheme to utilise their services. Many of them are skilled fitters, and are asking for opportunities to remain in work for which they have proved their capacity.—*Times.*

The Eight-Hour Day on the Continent.—The eight-hour day movement has been making great progress in different Continental countries during the past two months. At Warsaw a decree was published in November instituting an eight-hour day. According to the *Nowa Reforma*, the workmen in all industrial, economic, and trade industries, in all branches of communication, whether on land or water, and in all commercial enterprises, are to work a maximum of eight hours (not counting intervals for rest) except on Saturdays, when it is to be six hours. With the approval of the commune the six-hour day may be changed from Saturday to another week-day. According to *Glos Narodu* (December 2nd) the Cracow gasworks have instituted an eight-hour working day, though this will cost Kr.260,000 yearly; and have also decided to increase wages by 60 per cent., the cost to the gasworks being Kr.290,000. The sum of Kr.250,000 is to be allotted to provisioning the workmen. At Luxemburg the Government introduced the eight-hour working day system on December 1st, the measure affecting all big industrial works, including in particular the iron industry.

In Germany, according to the Government proclamation of November 12th, the eight-hour day was to be introduced on January 1st, 1919. There are to be certain exceptions, decided by the Imperial Labour Office, in the interests of certain economic and social needs of the nation. According to *Soziale Praxis* (November 28th), in Bavaria the new ministry for social welfare has been considering the best means of avoiding serious disturbance in economic matters, and has adopted the eight-hour day among other principles. Wherever, owing to technical obstacles, the introduction of more labour does not lead to increased production, employers and workers must agree to a 48-hour week, ending at noon on Saturday, any extra hours work being paid for at overtime rates. The demand for a 44-hour week is recognised and will be dealt with as soon as the difficulties of the present crisis have been overcome. Where shorter working hours already exist, no lengthening must be allowed. In general, the Government aims at shortening hours of work, in no case allowing them to exceed eight per day.

Welthandel (November 29th) says that an understanding between the trade unions and the employers' federation of the north-western group of the Union of German Iron and Steel Industries has been reached with regard to the introduction of the eight-hour day in the industry. Where circumstances permitted, this was to take place on November 25th, and where technical difficulties admit only of a gradual introduction, this is to be effected corresponding to the arrangement of the works. But, in any case, the measure is intended to be carried out completely by April 1st, 1919.

Another journal says that the metal industry in the M. Gladbach-Rheydt district has decided to adopt the eight-hour working day system and to raise the hourly scale of wages correspondingly.

Electricity on the Farm.—The daily Press states that Mr. A. T. Cock, of Ford Farm, St. Clear, Cornwall, has threshed out 15 sacks per acre of electrically-treated wheat, and 12 sacks per acre of untreated wheat. The straw of the treated crop was one-fifth more than the untreated. Barley grown by Mr. T. Maye, of Charleton, Devon, gave an increase of more than one-fifth over untreated, and another crop of barley grown by Mr. A. E. Stidson, of Barton, yielded half as much again as the untreated.

The *Auckland Weekly News* states that towards the end of 1917 Mr. Birks, engineer of the Lake Coleridge hydro-electric scheme, approached the Board of Governors of the Canterbury Agricultural College with regard to more extensive use of electric power on the farm. Mr. Birks fixed up the plant for a demonstration of threshing by electric power, and in all 34 acres were threshed. The outfit required consisted of a portable transformer supplied from the H.T. wires along the roadside, a few hundred feet of insulated cable leading to the motor, and a motor on a portable sledge, strong and heavy enough to act as a base. The drive was by an ordinary belt. The transformer stepped down the pressure from 11,000 to 400 volts. The motor used was of 15 H.P., while the maximum demand indicated was 12 H.P., and the average to run the plant used for the demonstration was 9 H.P. The running cost, if 12 H.P. was used, would work out at (taking town prices) 2s. 3d. per hour, which would compare more than favourably with steam. The advantages of electric drive from the point of view of the College are the ease and simplicity of manipulation, the steadiness of the running, and the lack of tendency to shift or get out of line—the motor remaining absolutely steady on its stand.

A Modern Test for High Resistance Joints in Line Wires.—Mr. M. A. Noss, of New York, writes in the *T. & T. Age* as follows:—A bad section, fully five miles long and thirty-three miles from the testing station, was reported. Following the usual method, a lineman was ordered to walk this section, count the joints in the wire, and to cut out joints that looked bad. He removed nineteen joints; all looked bad, but there was only one that showed high resistance when brought in and measured. He then devised a special form of milliammeter having three coils connected to one + terminal, the resistances of which were 100, 10, and 1 ohms. With this instrument the lineman went over this section again, and by shunting one to three joints, or a section between poles at one time, he was able to see at a glance if the joint or section was of high resistance, and by the rule of proportion could figure the actual resistance of what he had shunted. He knew when starting out the amount of current on this wire, or he could cut the milliammeter in the circuit at any time and find out.

On the trip he removed 37 joints measuring from 1½ to 192 ohms each, or a total of over 600 ohms. While he was doing this the wire was kept in service. He neither interfered with the working of the wire nor bothered the chief for instructions. He knew what he was after and could see it when he reached it. The trouble was on an old No. 6 iron wire. The test here described reduces the normal current through the joint under test, inviting a defect to develop. This instrument may also be used for testing fuses, and as a low reading voltmeter for testing batteries or any other low-voltage tests.

Elimination of Oil from Feed-water.—In a paper read before the Department of Marine Engineers of the Royal Institution of Dutch Engineers by J. C. Dijxhoorn, the importance of perfectly clean feed-water for steam boilers is dealt with. Ordinary appliances do not succeed in completely removing the oil, because it is in an emulsive state and divided into globules of less than 1/1,000 millimetre diameter which can pass through the finest filtering medium. Various precipitants are mentioned, but success depends in every case on subsequent filtration of the water through large sand filters. The tiny globules of oil can be made to coalesce by passing an electric current through the water, and the author describes an apparatus he has designed for this purpose, using continuous current at 110 volts whilst the water flows through the feed pipe. The electrically treated water is then sent through a pressure filter consisting of perforated cylinders covered with cloth and enclosed in a strong vessel provided with inlet and outlet stop valves. Such a filter has very little effect on ordinary feed water, but, as the electric process described above causes the oil-globules to coalesce, the whole of the oil is effectively retained, leaving pure water only to pass through. A pressure gauge on the filter indicates the condition of the filter cloth, which must be changed when filters. The tiny globules of oil can be made to coalesce by the pressure rises much above boiler pressure.—*De Ingenieur.*

A.S.E. and League of Nations.—The *Daily Chronicle* states that members of the Amalgamated Society of Engineers are about to take a vote on a proposed levy of 2d. per man to meet the expenses of propaganda in favour of a League of Nations.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station and Tramway Officials.—The Wigan Tramways Committee recommended that the new general manager, in succession to Mr. F. Buckley, who has been appointed tramway manager at Bury, should have a commencing salary of £500, rising by annual increments of £25 to £600. Alderman Fletcher, after referring to Mr. Buckley's valuable work at Wigan, said that if Bury, with fewer cars, could afford £500 for his services, Wigan could pay that sum to its manager. The poorest-paid manager in the tramway world was receiving £400 a year. The Council referred the minutes back.

The Northampton T.C. has presented an honorarium of £100 to the tramway manager (MR. J. CAMERON), in recognition of valuable services rendered during the war.

The Perth Corporation Electricity Committee has recommended an increase of £25 per annum to MR. C. J. LINDSAY, electricity treasurer.

General.—MR. J. M. KENNEDY, O.B.E., M.Inst.C.E., has resigned his position under the Ministry of Munitions as Superintendent of the Government Rolling Mills, Southampton, in order to rejoin his firm, Messrs. Kennedy & Donkin, consulting engineers. Mr. Kennedy was primarily engaged as chief engineer on the construction of the factory mentioned and its power house, the work being carried out by direct labour; subsequently, when the factory had been working some months, he was appointed superintendent. On the conclusion of hostilities the staff and employés, numbering over 2,000, presented Mr. Kennedy with a silver tea service, as a mark of the goodwill which existed among all ranks.

MR. HERBERT VICKERS, M.Eng., has been appointed chief assistant to the testing department at Faraday House.

MR. W. J. TERRY, recently supervisor of purchases for the B.T.H. Co., Ltd., has been appointed secretary of the London Electric Wire Co. and Smiths, Ltd., London and Salford, as from January 1st, 1919, and he will also assist in the management of the London undertaking.

MR. W. T. BOWER, late of the Metallic Seamless Tube Co., Ltd., and the Metallic Electrical Engineering Co., Ltd., has accepted an appointment as managing director of the Electrical Components, Ltd., switchgear and heating manufacturers, 36, Cannon Street, Birmingham.

CAPTAIN W. HALL and CAPTAIN F. B. C. SUTTHERY, A.M.I.E.E., Tyneside electrical engineers, have been seconded for service under the Admiralty, with effect from September 23rd, 1918, and October 3rd, 1918, respectively.

MR. W. ANDERSON, who has been with the General Electric Co. (Glasgow branch) for over 12 years, has resigned his position in order to become joint manager of Messrs. Wood & Cairns, Ltd., at their Glasgow branch.

MR. SIDNEY J. EBBUTT, one of the London outdoor representatives of W. T. Henley's Telegraph Works Co., Ltd., has been released from military service, and resumed his duties with the company on 13th inst. He has been a sapper in the London Electrical Engineers, R.E. (T.) for two-and-a-half years.

Roll of Honour.—The death took place at Dar-es-Salaam, East Africa, on December 23rd, of LIEUT. GEOFFREY H. WILSON, R.E. Signals, of cerebral malaria. The dead officer, who was only 34 years of age, was the founder and proprietor of the Manchester Armature Co., Pendleton, Manchester. After some months of volunteer service with the French Red Cross, he received a commission in 1915, and in May of the following year was sent to East Africa.

The Military Cross has been awarded to LIEUT. W. B. COCKBAIN, Machine Gun Corps, of Keswick, who was, prior to the war, engaged on the electrical staff at the Forge Engineering Works.

PRIVATE G. GERRARD, 1st Manchester Regiment, who died from pneumonia on December 27th, was employed by the British Westinghouse Co., Ltd., Trafford Park.

PRIVATE ALFRED RATCLIFFE, Trench Mortar Battery, who died whilst a prisoner of war, was formerly employed in the electricity department of the Burnley Corporation.

SERGT. J. L. MELBY, R.G.A., who has died in France from pneumonia, was formerly with the B.T.H. Co., Ltd., at Rugby.

LIEUT. R. F. PETSCHLER, R.E., has been awarded the Military Cross for gallantry in the field. Lieut. Petschler enlisted in 1915, and rose from the ranks. When he enlisted he was chief estimating engineer in Messrs. Johnson & Phillips's switchgear department; previously he held positions with the British Westinghouse Co. and with Messrs. Ferranti, Ltd.

Obituary.—MR. G. HAGGER.—Mr. George Hagger, who was for 24 years secretary of Messrs. Greenwood & Batley, Ltd., and the King's Norton Metal Co., Ltd., passed away on January 12th at Whitstable, aged 74 years.

NEW COMPANIES REGISTERED.

Inventions & Research, Ltd. (152,470).—Private company. Registered January 2nd. Capital, £30,000 in £1 shares. Owners of patents, schools, laboratories, and workshops for experimental and research work, &c. The subscribers (each with one share) are:—J. R. Remer, Cunard Building, Liverpool, sawmill proprietor; R. A. Corbet, Regent Palace Hotel, W., gentleman; W. A. C. Sandford-Thompson, 4, Cambridge Place, Kensington, engineer; S. Fitzgerald, 3, Thorpe Wood Avenue, Sydenham, engineer. First directors: J. R. Remer, R. A. Corbet, W. A. C. Sandford-Thompson, and S. Fitzgerald. Registered office: 4-6, Milner Street, Cadogan Square, W.

W. E. Beardsall & Co., Ltd. (152,506).—Private company. Registered January 3rd. Capital, £4,000 in £1 shares (3,000 preference). Electrical and mechanical engineers and contractors, manufacturers of railway, tramway, electrical, and other apparatus, suppliers of electricity, &c. The subscribers are: W. E. Beardsall, 130, Urmston Lane, Stretford, electrical fittings manufacturer (one ordinary share); W. E. G. Dean, 77, School Road, Stretford, purchasing agent (one ordinary share); C. A. Buckley, 2 Booth Street, Manchester, solicitor (one preference share). Permanent directors: W. E. Beardsall and W. E. G. Dean. Solicitor: C. A. Buckley, 2, Booth Street, Manchester.

Taylor & Petters, Ltd. (152,551).—Private company. Registered January 8th. Capital, £25,000 in £1 shares (12,500 8 per cent. cumulative preference). To take over the business of merchants and manufacturers of mica, micanite, celluloid, asbestos, and vulcanised fibre shades for electric and gas fittings and other goods carried on at 40, Hatton Garden, E.C., as "Taylor & Co." The subscribers are: J. M. Petters, M.Inst.C.E., 85, Palace Court, W.2 (one preference share); Miss J. Taylor, 20, Brookfield, West Hill, Highgate, N. 6, mica merchant (one ordinary share). First directors: S. Blofield, Miss J. Taylor, H. N. Lindley, and J. M. Petters. Solicitor: P. C. C. Francis, 19, Great Winchester Street, E.C.

Harris Electro Metals Co., Ltd. (152,542).—Private company. Registered January 8th. Capital, £5,000 in 4,750 preference shares of £1 each and 5,000 ordinary shares of 1s. each. To acquire from T. R. Harris the business of certain inventions, and to carry on at or near Thornhill or elsewhere the business of electro-depositors of metals, metal extractors and refiners, mechanical and electrical engineers, &c. The subscribers (each with one ordinary share) are: T. R. Harris, Calverley Villas, Dawley Road, Harlington, engineer; J. Harris, Windsor Street, Attercliffe Road, Sheffield, chemical engineer. The first directors are: W. B. Woodhouse, H. Ellison, T. R. Harris, and J. Harris. Solicitor: W. H. Clough, Town Hall, Cleckheaton.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Severn Engineering Co., Ltd.—Particulars of £3,500 debentures created December 9th, 1918, filed, the whole amount being now issued. Property charged: The company's property, present and future, including uncalled capital. No trustees.

Sentinel Instrument Co., Ltd.—Mortgage on freehold premises at Byker, Newcastle-on-Tyne, to secure £2,000. Holders: F. E. Hannay and E. Hannay, South Shields.

Z Electric Lamp Manufacturing Co., Ltd.—Satisfaction in full on September 30th, 1918, of first and second debentures, dated August, 1909, and September, 1910, secured by various deeds, securing £25,000 and £10,000 respectively.

Rawlings Bros., Ltd.—Charge on company's interest in certain under-leases and tenancy agreements, and on its book debts, stock, plant, fittings, furniture, &c., to secure £8,750. Holders: Mrs. M. Rawlings and others.

City of Oxford Electric Tramways, Ltd.—Satisfaction to the extent of £1,200 on December 12th, 1918, of charge dated 1914, securing £46,000.

Oriental Telephone and Electric Co., Ltd.—Satisfaction to the further extent of £856 on December 18th, 1918, of debenture stock secured by trust deed dated 1905, and supplementary deed of acknowledgement dated 1907, securing £200,000.

Ferguson, Pailin & Co., Ltd.—Satisfaction in full on October 21st, 1918, of charge dated November 14th, 1916, securing advances by Williams Deacon's Bank.

Rhondda Tramways Co., Ltd.—Satisfaction to the extent of £4,700 on December 12th, 1918, of charges dated 1911-15, securing £250,000.

CITY NOTES.

Compagnie Générale d'Electricité.

The directors of the Compagnie Générale d'Electricité, of Paris, reporting on the year ended on June 30th, 1918, state that all the company's manufacturing works suffered from the restrictions and the transport difficulties. The establishment erected at Saint-Jean-de Brave, near Orleans, for the manufacture of rifle grenades was changed over by order to the production of other articles, whilst the erection of the Vineey works (steel plant, rolling mills, and tube plant) was stopped, except in the case of tubes, at the request of the Ministry of Armaments, although the former would be started in the new financial year. Concerning the Société de l'Accumulateur Tudor, the report mentions that on the liberation of Lille, in October, 1918, it was found that the Thumesnil works had been completely pillaged by the enemy; almost all the plant had been removed, and what remained was put out of service. The situation of the supply undertakings in which the company is interested, which was serious for most of them, became aggravated in the case of that at Amiens. The net profits are returned at £192,000, as compared with £162,000 in 1916-17, and a dividend has been declared at the rate of 10 per cent. on the ordinary share capital of £1,400,000, being the same rate as in the preceding year. M. Pierre Azaria, speaking at the recent general meeting, remarked that peace would be favourable for the company. In the meantime they had to pass through a particularly difficult period. For the moment there was no longer any war, and special manufactures were coming to an end. But this was

not peace, and the directors had not at disposal yet either the framework and the specialised labour or the raw and semi-finished materials which were necessary. The tube factory, for instance, had been ready to start for weeks past, but was awaiting the delivery of coal and steel sheets. It was therefore essential that the transport crisis came to an end. The directors proposed as soon as circumstances would permit to erect a works complementing the Rai and Tillieres establishments which chiefly treated copper and aluminium and their alloys, and which were congested with work.

German Companies.

The Helios Elektrizitats A.G., of Cologne, is still in course of being wound up, and the liquidators report for 1917-18 shows that the loss of £419,000 shows no change as contrasted with the preceding twelve months.

The A.G. fur Elektrizitats Anlagen, of Berlin, records net profits of £31,000 for 1917-18, or practically the same as in the preceding year. The dividend at 6 per cent. on the ordinary share capital of £500,000 is also at the same rate as in 1916-17.

The accounts of the *Siemens Elektrische Betriebe A.G., of Berlin*, which owns various supply works, show net profits of £97,000 for 1917-18, as compared with £83,000 in the preceding year. It is proposed to pay a dividend of 5 per cent. on the old shares as in 1916-17, and 2½ per cent. on the new shares.

The financial statement of the *Wotan Werke A.G., of Leipsig*, indicates net profits of £59,000 for 1917-18, as against £30,000 in the previous year. A dividend at the rate of 25 per cent. has been declared, together with a bonus of £7 10s. per share, this distribution contrasting with a 40 per cent. dividend in 1916-17.

The report of the *Fabrik Isolierter Drahte (Vogel) A.G., of Berlin*, states that the net profits in 1917-18 amounted to £135,000, as against £63,000 in the previous year, the dividend being at the rate of 18 per cent., as in 1916-17. The company's subsidiary at Vienna has now been transferred to an Austrian company, with a paid-up capital of £125,000.

The Rhein. Elektrizitats Gesellschaft (late Rhenish Schuckert Co.), of Mannheim, has just declared a dividend at the rate of 5 per cent. out of net profits of £50,000 in 1917-18, being the same rate as in 1916-17, when the net profits were £46,000. At the recent general meeting it was stated that the company's undertaking and its subsidiaries had been greatly expanded during the war, and very acceptable circumstances would arise if the possibility soon occurred, as was hoped, of resuming installation and station work.

The Elektrizitats A.G. vorm. Schuckert & Co., of Nuremberg, reports gross profits of £486,000 in 1917-18, as contrasted with £466,000 in 1916-17. After setting aside £179,000 for depreciation, as against £166,000, and making provision for the tax on coupons, the accounts show net profits of £372,000, as compared with £375,000 in the preceding year, these figures including the balance brought forward in each year. The directors recommend a dividend of 8 per cent., being the same rate as in 1916-17.

The accounts of the *Siemens-Schuckert Werke, of Berlin*, have been issued for the year ended July 31st, 1918. Including the balance forward, the gross profits are stated to be £1,347,000, as compared with £1,325,000 in the previous year. After defraying general expenses and interest on loans, the net profits are £791,000, as against £793,000 in 1916-17, permitting of the payment of a dividend of 10 per cent. to each of the two partners, as in the preceding year. The sum of £125,000 has been placed to the reserve fund, as in 1916-17, and £25,000 to the contingency fund, whilst the bonuses to officials and workmen have risen from £100,000 in 1916-17 to £150,000 last year.

The accounts of *Siemens & Halske A.G., of Berlin*, dealing with the year ended on July 31st, 1918, show gross profits of £887,000, as contrasted with £895,000 in the previous 12 months. Having provided for general expenses, interest on loans and depreciation, the net profits are reported at £697,000, as against £643,000 in 1916-17. It is proposed to pay a dividend of 12 per cent., being the same rate as in 1916-17; to allot £150,000 as economic assistance to the staff for the year, and to pay bonuses to officials and workmen to the extent of £90,000, as compared with £60,000 in 1916-17, and to carry £61,000 forward.

Stock Exchange Notices.—Applications have been made to the Committee to allow the following to be quoted in the Official List:—

Erinoid, Ltd.—440,000 shares of 5s. each, fully paid (Nos. 1 to 440,000).

Marconi International Marine Communication Co., Ltd.—600,000 shares of £1 each, fully-paid (Nos. 1 to 600,000).

Anglo-Portuguese Telephone Co., Ltd.—150,000 shares of £1 each, fully paid, Nos. 1 to 150,000.

Buenos Aires Lacroze Tramways Co., Ltd.—£65,400 additional 5 per cent. consolidated mortgage debentures.

Alby United Carbide Factories, Ltd.—Interim dividend 6 per cent. on the ordinary shares.

Nitrogen Products and Carbide Co., Ltd.—Interim dividend 9 per cent.

Underfeed Stoker Co., Ltd.—Interim dividend at the rate of 5 per cent., less tax.

Compañia Anglo-Argentine de Electricidad, Sociedad Anónima.—For the year ended July 31st, 1918, the revenue amounted to $2,904,021 m/n., compared with $2,741,084 m/n. in 1917. Working expenses increased by $600,000, compared with a normal year, one item alone, oil, increasing from $25 per ton in 1915 to $165 per ton in the year under review. Applications to the towns supplied by the company for increased tariffs were only very slightly successful in a few instances. The credit balance was $402,950 m/n., of which $150,000 was placed to the depreciation and reserve fund, $100,000 to the contingency fund, $50,000 to writing down "issue of debentures," $20,000 to special amortisations, $16,754 to legal reserve fund, $11,697 to writing down improvements to $1, $8,271 to the board and syndic fund, and $46,228 was brought forward. In view of the uncertainty of the position, the Board did not recommend the payment of a dividend.—*Review of the River Plate.*

Companies Struck Off the Register.—The following companies have been struck off the register and are accordingly dissolved:—

Afflecks Engineering Works, Ltd.
Carleon Electrical Co., Ltd.
Chinnerys, Ltd.
Co-operative Publicity Co., Ltd.
Cordingley's Calculators, Ltd.
David Wilson's Patent Noiseless Winch Co., Ltd.
Electric Lamp Repairs, Ltd.
Illuminated Posters, Ltd.
J. M. Shock Absorbers, Ltd.
Lounge Electrics, Ltd.
Manchester Cable Co., Ltd.
Printex Accumulator Co., Ltd.
Universal Electric Canoe Co., Ltd.

Dublin United Tramways, Ltd.—Final dividend at the rate of 6 per cent. per annum, less income tax, for the half-year to December 31st (making 5 per cent. for the year) on the ordinary stock, and a bonus of 1s. per £10 unit of ordinary stock, free of income tax. £35,000 is set aside to meet deferred replacements of cars and renewals of rails, and £15,000 to reserve fund. £3,262 is carried forward.

Delaboie Electric Light & Supply Co., Ltd.—There is a profit on the year's working of £59, and a balance carried forward of £31.

STOCKS AND SHARES.

TUESDAY EVENING.

THE serious disorders which have occurred in Buenos Aires had the effect of making the markets in Argentine issues decidedly weak. These are, however, amongst the few departments that exhibit any signs of dulness round the Stock Exchange. In point of fact, prices in most markets are hard, and have a tendency to rise. There is plenty of money about for investment, nor has the fact that this is the last week when National War Bonds can be obtained in their present shape had any particular influence in checking investment in other directions. The industrial market shows strength in most of its sections, and further rises have occurred amongst electricity supply shares.

No diminution in the buoyancy of Undergrounds is noticeable. Prices continue to mount. Districts have risen 2 to 28, and Metropolitans recovered a point to 32. In Underground income bonds and the 1s. shares a large volume of business is in progress. The price of the bonds has advanced to 95—is better, in fact, than might be inferred from the official quotation, while the 1s. shares are up to 10s. 3d. Those optimists who anticipate the immediate resumption of a 6 per cent. dividend on the income bonds may be well advised to moderate their prophecies, but in the more or less near future, no doubt this dividend will be paid. Transport facilities in London are taxed to their utmost capacity, and there seems little enough hope of relief to the unhappy strap-hanger. All this, of course, is to the good of the holder of Tube securities, whose comfort increases in corresponding ratio with the discomfort of the traveller. We hear interesting rumours of schemes in preparation for the provision of light railways in country districts. The Ministry of Reconstruction is alive to the opportunities offered by the materials now freed by the conclusion of the war, and financial support is not likely to prove wanting.

Anglo-Argentine Tramways preference shares, and both classes of debenture stocks, have given way somewhat sharply on the strikes and disorders in the streets of Buenos Aires. The markets for these issues had been previously so good that it was difficult to get the offer of stock. Strikes have changed all that, and although the difficulties are declared to have been composed, prices are still weak. To a minor extent, the dulness has spread to Brazilian and other South American securities, although up to the present Rio Tramway bonds remain quietly steady. There is little doing in the Mexican group, the tendency being for prices to give way in the absence of interest on the part of the purchaser, or of any news worth the name from the country itself. Mexico Tramways sixes are 1½ lower. Brazilian Tractions shed a point to 56, but the preferred at 94 are 1 to the good.

North Metropolitan Power preference shares, of which mention was made here last week, have been readily ab-

sorbed, and we believe it to be a fact that the total number of shares offered are now all placed. The price has improved to 18s. 9d., and seeing that the shares have mostly gone into the hands of the genuine investor, the quotation will probably mount to the neighbourhood of 20s. and stop there.

The electric supply market is a good one. Buyers have again come forward, professing that they care little for immediate dividend prospects, but that they are content to wait with a view to the undertakings regaining their former prosperity within a year or two. Therefore, even if the forthcoming dividend announcements should prove to be disappointing, they are not likely to have any adverse effect upon the prices of the shares, and the present buying movement is on behalf of individual investors fully aware that the next batch of dividends is not likely to be a good one.

Marconi shares have been a weak spot. The parent issue fell to 4¼, and Americans went back abruptly to 27s. 6d., though Marines are fairly well maintained at 3¾. In default of any definite reason to account for the drop, a vague rumour got into circulation as to possibilities of competition, but nothing certain is known. Apart from Marconis, the general market is a good one. Anglo-American Telegraph preferred rose to within 10s. of par, and the rest of the list maintained the advances secured last week. India-rubber shares have improved 5s. to 17½, and amongst industrials connected with the electrical manufacturing companies, Edisons are a good spot at 19s. 3d. Babcock & Wilcox rose to 3¾. Electric & General investment preference improved to 3½. Cordoba Light & Power ordinary went up 9d. to 3s. 9d. Melbourne Electric first preference at 5⅞ are ¼ higher. The market for rubber shares is generally steady, and there is still a good deal of buying of the popular shares. The armament group keeps firm, but base metal descriptions are inclined to move downwards, as the prices of metals further gave way.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1916.	Dividend 1917.	Price Jan. 14, 1919.	Rise or fall.	Yield p.c.
HOME ELECTRICITY COMPANIES.					
Brompton Ordinary	9	10	7½	—	£6 15 7
Charing Cross Ordinary	5	4	3⅝	—	5 10 4
do. do. do. 4½ Pref.	4½	4½	3¾	+ ¼	6 8 7
Chelsea	3	5	4	—	6 5 4
City of London	8	8	13½	—	6 0 9
do. do. 6 per cent. Pref.	6	6	10½	—	5 18 5
County of London	7	7	11½	—	6 5 7
do. do. 6 per cent. Pref.	6	6	10½	—	5 18 5
Kensington Ordinary	6	7	6	+ ¼	5 16 8
London Electric	Nil	Nil	1¼	—	Nil
do. do. 6 per cent. Pref.	4	5	4	—	6 5 0
Metropolitan	3	4	3	—	6 13 4
do. 4½ per cent. Pref.	4½	4½	3½	—	6 18 6
St. James' and Pall Mall	8	9	7½	+ ¼	6 4 2
South London	3	3	3	—	6 13 4
South Metropolitan Pref.	7	7	21/-	—	6 13 4
Westminster Ordinary	7	9	7½	+ ¼	6 2 0
TELEGRAPHS AND TELEPHONES.					
Anglo-Am. Tel. Pref.	6	6	99½	+ ½	6 0 6
do. Def.	1½	1½	23½	—	6 9 6
Chile Telephone	8	8	7⅞	—	5 5 0
Cuba Sub. Ord.	7	7	10½	—	*6 18 4
Eastern Extension	8	8	15½	—	*5 2 5
Eastern Tel. Ord.	8	8	158½	—	*5 1 0
Globe Tel. and T. Ord.	7	7	14½	—	*4 16 5
do. do. Pref.	6	6	10⅝	—	5 14 3
Great Northern Tel.	22	22	32½	—	6 15 0
Indo-European	13	13	58½	—	5 11 0
Marconi	15	20	4¼	— ¼	4 9 0
Oriental Telephone Ord.	10	10	2½	—	4 0 0
United R. Plate Tel.	8	8	8	—	*5 0 0
West India and Panama	6d.	1/3	1½	—	*3 12 6
Western Telegraph	8	8	10⅜	—	*4 16 3
HOME RAILS.					
Central London Ord. Assented	4	4	65½	—	6 2 2
Metropolitan	—	1	32	+1	3 2 6
do. District	Nil	Nil	28	+2	Nil
Underground Electric Ordinary	Nil	Nil	3⅜	+ ⅛	Nil
do. do. "A"	Nil	Nil	10/3	+ /3	Nil
do. do. Income	6	4	95	+1	*4 4 3
FOREIGN TRAMS, &c.					
Adelaide Sup. 6 per cent. Pref.	6	6	41	—	6 6 4
Anglo-Arg. Trams. First Pref.	5½	5½	84	+ /3	—
do. do. 2nd Pref.	5½	—	28	— ½	—
do. do. 5 Deb.	5	5	72½	—2	6 18 0
Brazil Tractions	—	—	56	—1	—
Bombay Electric Pref.	6	6	102	—	5 11 7
British Columbia Elec. Rly. Pfce.	5	5	67½	—	7 11 5
do. do. Preferred	Nil	Nil	50	—	Nil
do. do. Deferred	Nil	Nil	45	—	Nil
do. do. Deb.	4½	4½	62	—	6 17 3
Mexico Trams 5 per cent. Bonds	Nil	Nil	67	—	Nil
do. 6 per cent. Bonds	Nil	Nil	52	—1½	Nil
Mexican Light Common	Nil	Nil	38	—	Nil
do. Pref.	Nil	Nil	48	—	Nil
do. 1st Bonds	Nil	Nil	70	—	—
MANUFACTURING COMPANIES.					
Babcock & Wilcox	15	15	3¾	+ ¼	3 17 6
British Aluminium Ord.	10	10	1⅛	—	8 8 1
British Insulated Ord.	20	20	3½	—	4 9 0
British Westinghouse Pref.	7½	7½	9¾	—	6 0 0
Callenders	20	25	10⅜	—	5 19 1
do. 6% Pref.	5	5	6¾	—	5 2 4
Castner-Kellner	22	20	3⅝	—	6 18 6
Edison-Swan, "A"	—	—	19/3	+6d.	7 16 0
do. do. 4 per cent. Deb.	4	4	74½	—	5 7 0
Electric Construction	7½	10	1⅝	—	8 0 0
Gen. Elec. Pref.	5	6	10⅜	—	5 5 4
do. Ord.	10	10	17½	—	*5 12 8
Henley	25	25	3½	—	6 11 2
do. 4½ Pref.	4½	4½	4	—	5 12 6
India-Rubber	10	10	17½	+ ½	*5 18 0
Telegraph Con.	20	20	4⅜	—	*5 0 0

* Dividends paid free of Income Tax.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, January 15th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Oxalic	per lb.	1/5	..
a Ammoniac Sal	per ton	£80	..
a Ammonia, Muriate (large crystal)	"	£77	..
a Bisulphide of Carbon	"	..	..
a Borax	"	£43	..
a Copper Sulphate	"	£40	..
a Potash, Chlorate	per lb.	9/1	..
a " Perchlorate	"	1/9	..
a Shellac	per cwt.	£14	£3 10s. dec.
a Sulphate of Magnesia	per ton	£15	..
a Sulphur, Sublimed Flowers	"	£23	£1 dec.
a " Lump	"	£15	£1 dec.
a Soda, Chlorate	per lb.	10½d.	2½d. dec.
a " Crystals	per ton	£7	..
a Sodium Bichromate, casks	per lb.	..	..
METALS, &c.			
c Brass (rolled metal 2' to 12' basis)	per lb.	1/1½	..
c " Tubes (solid drawn)	"	1/3½ to 1/4	..
c " Wire, basis	"	1/2	..
c Copper Tubes (solid drawn)	"	1/6½	1½d. dec.
g " Bars (best selected)	per ton	£135	£15 dec.
g " Sheet	"	£115	£15 dec.
g " Rod	"	£135	£15 dec.
d " (Electrolytic) Bars	"	£105	£17 dec.
d " " Sheets	"	£161	..
d " " Wire Rods	"	£115	£17 dec.
d " " H.C. Wire	per lb.	1/1½	1½d. dec.
f Ebonite Rod	"	3/-	..
f " Sheet	"	2/8	..
n German Silver Wire	"	2/6	..
h Gutta-percha, fine	"	11/-	..
h India-rubber, Para fine	"	2/6	1½d. dec.
i Iron Pig (Cleveland warrants)	per ton	Nom.	..
l " Wire, galv. No. 6, F.O. qual.	"	£40	£3 inc.
g Lead, English Pig	"	..	..
g Mercury	per bot.	Nom.	..
e Mica (in original cases) small	per lb.	9d. to 4/6	..
e " " medium	"	5/- to 10/-	..
e " " large	"	12/6 to 25/- & up.	..
d Silicium Bronze Wire	per lb.	1/7	1d. dec.
r Steel, Magnet, in bars	per ton	..	..
g Tin, Block (English)	"	£250	..
n " Wire, Nos. 1 to 16	per lb.	1/8	..

Quotations supplied by—

a G. Boor & Co.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd
n P. Ormiston & Sons.
r W. F. Dennis & Co.

The Demand for Electrical Material in China.—The use of electric appliances is naturally limited to those cities and districts where electric power is obtainable, and the constant growth of this trade under these circumstances is promising. A great many electric power plants have been unable to get machinery during the past year to take care of natural increases in consumption, and new contracts for current have been subsequently refused. With an increased import of appliances under such circumstances we can only infer to what size the business would have grown under normal conditions. The following figures show the increase in the value of the imports of electrical materials and fittings during the three years up to 1918:—

	1915. Haikwan taels.	1916. Haikwan taels.	1917. Haikwan taels.
Japan	845,053	1,699,111	2,563,557
United States	314,403	614,321	908,960
Hong-Kong	259,585	339,992	381,287
Great Britain	403,851	710,744	379,693
Canada	3,181	73,863	58,941
All other countries	288,339	130,681	85,953
Total imports	2,114,415	3,568,712	4,378,391
Re-exports	71,525	137,141	351,148
Net imports	2,042,890	3,431,571	4,027,243

—*Journal of Electricity*, U.S.A.

Staggered Hours.—At a recent meeting of the Boston section of the A.I.E.E., L. L. Elden, electrical superintendent of the Boston Co., said that to add 15,000 KW. to the existing plant capacity during 45 winter days it would be necessary to change the working hours of about thirty industrial plants only about thirty minutes. The above saving represents about one-sixth of the total estimated peak load of the Boston system for the winter. The comparatively small change in closing hours required to realise so substantial an increase in available station rating was something of a surprise to those investigating the possibilities.—*Electrical World.*

INDUSTRIAL RECONSTRUCTION AND THE METRIC SYSTEM.

[The necessary expansion of our export trade, coupled with the imminent establishment of new industries and of new standards in old industries, calls for a reconsideration of the claims of the international metric system as the universal language of quantity.]

BY HARRY ALLCOCK, M.I.E.E.

ECONOMIC considerations now render the expansion of our export trade just as necessary in the national interest as was the production of munitions during the war.

Great Britain is no longer the sole workshop of the world, and as most of the other producing nations are faced with the same economic problem it follows that international competition will be exceptionally keen. We have not only to secure our re-entry into those overseas markets which have been temporarily lost during our concentration on war work, but also to create new markets for British goods throughout the world. No effort must be spared, and all hampering influences must be eliminated.

Hitherto the general charge has been frequently made that we have not sufficiently considered the convenience of our overseas customers, and that, in particular, we have hampered our own prospects by failing to submit our offers in the language of the country concerned.

In this connection we are apt to forget that, although there are scores of spoken languages, there are now substantially only two languages of quantity, viz., the British Imperial system and the international metric system of weights and measures.

If either of these systems were adopted by the whole world as the *sole* language of quantity the conduct of international trade would obviously be greatly simplified, and it is clear that Great Britain more than any other country would benefit from such uniformity due to her special dependence upon her world-wide export trade.

Looked at from this point of view, it would appear that sooner or later Great Britain must abandon the British Imperial system, because even its stoutest supporters would refuse to undertake the impossible task of inducing the world to adopt it.

On the other hand, apart from its inherent excellence as a system, the points in favour of our adoption of the International metric system may be briefly summarised as follows:—

1. *Education.*—The committee recently appointed by the Prime Minister to inquire into the position of Natural Science in the educational system of Great Britain (Cd. 9,011) reported: "That the present chaos of English weights and measures causes waste of time and confusion of thought, and that there are strong educational reasons for the adoption of the metric system."

2. *Science and Industry.*—The scientists of the whole world including those now working in the so-called "non-metric" countries have already adopted the metric system. The experiences of war have proved the advantages of close co-operation between the scientist and the industrialist, and to that end it is desirable they should both work in the same system.

3. *Technical Progress.*—The ordinary rate of evolution in many industries has been accelerated by the experience of war to such an extent that "the best practice" of pre-war days is already obsolete. Extensive "scrapping" of patterns, &c., is inevitable, and a unique opportunity of starting afresh on the metric basis in thus provided.

4. *Commercial Progress.*—Just as in labour matters both employers and employed now fully realise the impossibility of returning to pre-war conditions and practices, so also on the commercial side are British manufacturers now disposed to develop new industries and to set up new standards in old industries, instead of merely reverting to the output of their unaltered pre-war products. By basing all new developments on the metric system, manufacturers would help themselves as well as the nation.

5. *Overseas Consumers.*—Our overseas customers may be considered under three heads, viz.:—

(*a*) Our Colonies.
(*b*) Our Allies.
(*c*) General.

(*a*) *Colonies.*—This trade is reasonably preserved for us (no matter what system of weights and measures we employ), both by ties of national sentiment and by the Government's declared policy of Colonial Preference. It may also be observed that the Colonies have frequently expressed their desire to adopt the metric system whenever the United Kingdom does so. In the Dominions Royal Commission Report of 1917 the following statement with reference to the metric system was published: "There is clearly in the Dominions a considerable body of opinion in favour of the change. So far, however, all efforts to induce the *community of the Mother Country* to agree to the change have proved unavailing." We should accordingly not jeopardise our Colonial trade by adopting the metric system.

(*b*) *Allies.*—All our European Allies have already adopted the metric system, and by now following their lead in this matter we should not only encourage them to entrust to British firms the temporary work of restoring and re-equipping their war-damaged factories, but we should thereby foster a spirit of permanent alliance by promoting the development of inter-allied trade to its fullest possible extent.

(*c*) *General.*—If we regard the peoples of the entire world as potential consumers of British goods we must necessarily adopt the international metric system, because its use is now obligatory in some 34 countries (representing approximately half the population of the world), and legally permissive in practically all other countries.

In addition it is recently reported that Russia (where hitherto its use has been merely permissive as in England) has decided to render the employment of the metric system compulsory throughout that country after a short transition period.

Even if they strenuously object to the metric system, British manufacturers and merchants thus cannot avoid its use, and the only escape from their present obligation to employ two systems—involving increasingly frequent conversions from one to the other—is for them to abandon the British system.

In the face of these arguments, it may well be asked, "Why does Great Britain continue to postpone her inevitable adoption of the metric system?"

OBJECTIONS.

Apart from our innate conservatism the principal objections hitherto advanced are here enumerated, together with a few comments under each head:—

1. *That the use of the metric system is already legally permissive in this country, and that its alternative use side by side with the British system should result in the ultimate survival of the better system without compulsory legislation being introduced.*

The flaw in this argument is that it is impracticable to have, for instance, two sets of scales in different systems in concurrent use on a shopkeeper's counter. The system in possession, however bad it may be, will never disappear except under compulsion.

2. *That those who desire the introduction of the metric system should lead the way by conducting their own business solely in that system.*

Without some clear indication that the Government will later enforce the general use of the metric system this suggestion is unreasonable, because our industries cannot be regarded as watertight compartments. Any industry so acting in advance of other industries and transport authorities with which it is in daily contact, would merely penalise itself by its voluntary isolation. In this respect the position is analogous to that of the Daylight Saving Reform, from which no benefit could be derived until it was made compulsory.

3. *That the obligation to supply spare parts and renewals of machinery made to British measurements prevents British manufacturers from now adopting the metric system.*

This objection evidently arises from an unwarrantable assumption that our adoption of the metric system would necessarily involve altered dimensions of machine parts. Such is not the cause, because obviously any dimensions now expressed in inches and parts thereof can readily be expressed in millimetres and parts thereof.

The suggestion that metric equivalents can only be shown by employing six figures or so after the decimal point is shown to be without practical foundation when we remember that a tolerance of even one-hundredth part of a millimetre (0.01 mm.) demands much more accurate work than is usually obtainable in our machine shops. Furthermore, it may be observed that equivalents expressed even so approximately as to the nearest whole millimetre—thus dispensing entirely with the decimal point—could not differ from the original Imperial dimensions by more than one-fiftieth part of an inch, and even this degree of accuracy would suffice for the majority of dimensions excluding, of course, those of machine bearings and the like.

Finally, it should be remembered that the obligations to supply spare parts of existing machines has never yet prevented the progressive manufacturer from altering his designs from time to time so as to embody improved features. Many such changes are likely to be made at the present time, due to the war-accelerated evolution in technical progress, and to the new outlook of British manufacturers in the consideration of their peace programmes.

4. *That the opposition of the textile trade is an insuperable objection.*

The British textile trade and its nomenclature claims to be so firmly established throughout the world that it is immune from the international competitive influences to which other British trades are subjected. Assuming this to be the case, it is, in itself, no reason why other less privileged British industries should be perpetually handicapped.

The Swiss watch industry, which similarly held out against Switzerland's adoption of the metric system was accommodated by being specially exempt from the compulsory provisions of the Swiss Metric System Act. Ultimately the Swiss watchmakers realised that they had denied themselves advantages enjoyed by their fellow countrymen, and they accordingly came into line voluntarily by themselves adopting the metric system.

Furthermore, according to the recent report by the Committee on Commercial and Industrial Policy (Cd. 9.035): "Of the yarns exported in 1913 about one-third was taken by Germany" (already a metric country), and "rather more than half of the total exports of piece goods went to British possessions." None of this trade would be jeopardised by our adoption of the metric system, and in any case the sale of textiles in terms of the metric system is a relatively simple procedure already widely practised.

5. *That if we now adopted the metric system we should be at a disadvantage in competition with Germany.*

The metric system is not a German system, but, in spite of the anti-French sentiment then existing, Germany adopted the metric system from France immediately after the Franco-Prussian War. Since that time 24 other countries have likewise adopted what is now truly described as the *International* metric system, and we accordingly remain a "non-metric" country to our own serious disadvantage.

If it be argued that until they became expert in the use of the metric system British manufacturers and merchants would be at a disadvantage as compared with similar classes in Germany, it may be observed that such a temporary handicap must be faced sooner or later, and, this being the case, it would be a positive advantage for us to accept it now.

At the present time the sentiment of the world is anti-German, due to Germany's callous disregard of international and human laws during the war. We, however, cannot rely on such a sentimental protection favouring us indefinitely, and should therefore act promptly, and get through our transition troubles before Germany is rehabilitated in the world's esteem.

6. *That while our trade with "metric" countries might be stimulated we should jeopardise our trade with "non-metric" countries.*

This suggestion evidently arises from a superficial survey of official statistics which show that our pre-war exports to "metric" and "non-metric" countries respectively were approximately equal. This bare statement needs modification owing to the factors detailed above under the heading "Overseas consumers."

By eliminating the values of our exports to our Colonies and to Russia from the "non-metric" side of the balance sheet, and by noting the prospect of closer trade relations with our European Allies, the volume of "non-metric" trade sinks into comparative insignificance. There is no evidence to show that any of our "non-metric" trade would be jeopardised by our adoption of the metric system.

7. *That the United States still retains the British system.*

It is necessary we should appreciate that the manufacturers of the United States have hitherto been primarily concerned in supplying the needs of their own country and of the English-speaking "non-metric" countries comprised within the British Empire.

The passing of the Webb-Pomerene Act (legalising trade combinations for export purposes), and other indications, show that America now aspires to be an exporting nation in the widest sense, and it is accordingly not surprising to find that Americans are now regarding the metric system with increasing favour. *Vide* appended extract from *Board of Trade Journal*, December 19th, 1918.

There can be little doubt but that whether the United Kingdom or the United States first adopts the metric system, the other would rapidly follow, and, having regard to our relatively greater dependence upon our export trade, it is obviously incumbent upon Great Britain to make the first move although it would not be surprising to find the less conservative Americans taking the lead.

Government Action Needed.

Assuming that in the national interests, the exportation of manufactured goods must be increased, it is obviously the duty of the Government to facilitate international communications.

From the above notes it is clear that our use of the international metric system would be a useful step in that direction.

The Act of 1897 legalised the metric system in this country, but experience has shown that further Government action is required to bring it into general use.

It is accordingly suggested that the Government should forthwith announce that, having regard to its desire to simplify education, to assist in the re-establishment of British industries on a scientific basis, and to promote the development of British export trade, it has decided:—

1. To encourage the more widespread use of the international metric system both in the United Kingdom and in the British Empire generally by officially recommanding all British manufacturers hereafter engaging in new industries or introducing new standards into existing industries, to base their operations on the metric system on the distinct understanding that the Government will adopt that system as the sole legal system of weights and measures as and from ..... (a date, say, five years hence) or upon such later date as Parliament may then decide.

2. To specify hereafter the requirements of all Government Departments in terms of the metric system wherever possible, and to recommend other public and semi-public buyers (*e.g.*, Home and Colonial Governments, municipalities, railways, harbours, &c.) to follow their lead in the national interest.

3. To require the railways and other transport companies to accept consignments of goods described in terms of the metric system without demanding a statement of British equivalents.

4. To prepare the way for the complete change-over from the British Imperial system to the International metric system:—

(*a*) By forthwith extending the practice already adopted of establishing metric standards by Order in Council, *e.g.*, on October 14th, 1913, the metric carat of 200 milligrams was ordained the legal standard of weight for precious stones and pearls).

(*b*) By forthwith abolishing all apothecaries weights in favour of metric weights throughout the entire trade in fine chemicals and drugs.

(*c*) By forthwith abolishing many of the multiples of existing British units, and by requiring all quantities to be expressed of units of single units instead of in a complex of units, *e.g.*, to express weight in lb. instead of in tons, cwt., qr., lb.

5. To prohibit the modification of existing British units or the introduction of any new units other than metric units.

6. To publish all official British trade statistics in terms of the metric system, retaining for a few years their British equivalents where necessary.

7. To require all scholars in public elementary schools to be efficiently taught the international metric system.

8. To require all applicants for appointments in the Civil Service and other Government Departments to have a working knowledge of the International metric system.

9. To advise the Overseas Governments of the British Empire and of the United States of America that the British Government has decided to adopt the international metric system as its sole legal system of weights and measures, and to invite them to take similar action, so as to secure its establishment as the universal language of quantity at the earliest possible date.

10. To act promptly along the above lines, so that British manufacturers and merchants may frame their peace programmes with full knowledge of the Government's intentions, and by their extended voluntary use of the metric system anticipate its compulsory employment by the entire community.

Extract from the *Board of Trade Journal* dated December 19th, 1918, page 781.

UNITED STATES OF AMERICA.

International High Commission and the Metric System.

"More extensive use of the metric system in the trade and commerce of the United States is recommended in a resolution adopted by the United States section of the International High Commission, of which Secretary McAdoo is chairman, according to a statement issued by the Treasury Department. The statement follows:—

"The Commission has regarded this subject as of particular importance in the United States. It is, of course, unnecessary for the United States section to recommend to the Latin-American sections of the Commission anything in connection with the metric system, which is exclusively in use throughout Latin-America.

"One of the main obstacles to documentary uniformity as between the United States and Latin-America is to be found in the fact that the United States does not make the use of the metric system obligatory, and consequently its consular documents have to allow the use of that system merely as optional. Any uniform system of classifying merchandise, however, will require on the part of the United States thorough-going and complete adherence to the metric system.

"*Use in Trade.*—Of more importance than statistical and administrative questions is the use of the metric system in trade. Now that the United States is being drawn into closer and more vital commercial relations by the rest of the world, and particularly with Latin America, her manufacturers and exporters will be obliged, the report states, to meet the demands of their prospective customers in a somewhat more accommodating frame of mind than hitherto. Only the English-speaking nations still have to adopt the metric system of weights and measures, and among them the British Empire, or at least Great Britain, seems to be giving serious consideration to the necessity of making a change."

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

An Electric Accumulator Shunting Locomotive.

We illustrate herewith a new electric battery locomotive, recently built at the Horwich works of the Lancashire and Yorkshire Railway Co., which is now being used for shunting purposes at the company's electric power station at Clifton Junction. The motors are capable of hauling three loaded 20-ton coal wagons, or a load of 90 tons, on an incline of 1 in 189, in addition to the weight of the locomotive, which is 17 tons 18 cwt. The locomotive was built in substitution for five electric capstans, and it is capable of dealing with twice the load at twice the speed, as compared with capstans, as

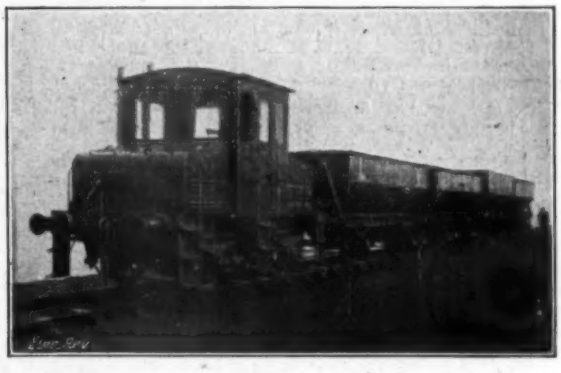

FIG. 1.—ACCUMULATOR LOCOMOTIVE FOR SHUNTING.

well as doing it at a lower capital and operating cost. The locomotive can be operated by one man, and, when the work is not continuous, this man can perform other duties, as the machine can be left without any attention, although it is ready at a moment's notice to perform shunting work. The equipment consists of two British Thomson-Houston motors, of 18 H.P. each, at hourly rating; the gearing has a ratio of 4.6 to 1. The battery consists of 120 Chloride I.M.V. 6-type "Ironclad-Exide" cells, the capacity of which is 71 KW.-hour at the 4½-hour rate. The total weight of the battery is 5,040 lb. The type of cell used is that commonly employed by the Chloride Co. for road vehicles, but in this instance the ebonite containers are made with thicker walls than in cells of the standard pattern. It is claimed that if the working instructions are adhered to, a life of any thing up to 1,000 cycles of charge and discharge may be

expected from this battery, and, with careful treatment, a mileage of 25,000 miles has been secured from similar batteries without any electrical repairs being necessary. The battery is divided into two parts, so that the two portions can be used in parallel, to give a voltage of 120, or in series to give 240 volts. The capacity of the battery will admit of 3.2 hours' continuous shunting, or a 4-hour continuous run "light" on the level, at an average speed of 20 miles per hour. During the dinner hour it is usual to give a boosting charge, which will give back to the battery 40 per cent. of its total charge, raising the shunting capacity to 4¼ hours. The motors are controlled from the cab by a series-parallel controller on the motors at 120 or 240 volts. There are ten notches on the controller for both voltages; the 120-volt supply is used for shunting purposes, giving a speed of about 4¼ miles per hour, and the 240-volt supply for running from place to place at 20 miles per hour on the level. The tractive effort at the tread of the wheel up to 2.3 miles per hour is 5,400 lb., and at 4 miles per hour 2,500 lb., at the hourly rating. The wheels are 3 ft. in diameter, spaced 9 ft. apart, and the total length over buffers is 21 ft. 11 in. The locomotive is fitted with the vacuum brake as well as a hand brake. The vacuum is produced by means of a small electrically driven exhauster worked from either half of the battery. There is a commodious cab, and the engine has a very neat and workmanlike appearance.

Street Lighting at Oxford.

Oxford is the first city in England in which the new form of illumination by Holophane refractor lanterns in conjunction with gas-filled lamps has been adopted for public lighting. These refractor lanterns have been introduced to solve

FIG. 2.—HOLOPHANE REFRACTOR LANTERN.

the problem of securing uniform lighting and of reducing the diversity factor to a minimum. At Oxford the main streets are illuminated by medium-size Holophane refractor lanterns provided with 300-watt gas-filled lamps, on old arc-lamp posts 22 ft. high. The spacing ratio varies from 7.9 to 13, and the illuminating diversity factors from 7 to 17

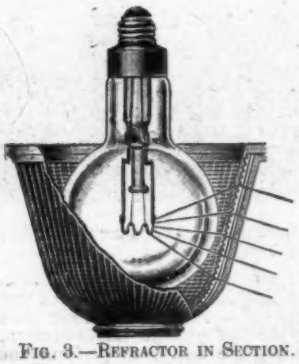

FIG. 3.—REFRACTOR IN SECTION.

respectively, the maximum illumination being 0.495, and the minimum 0.027 and 0.028 foot-candles at the pavement level. From these figures it will be seen that with this system a remarkable uniformity is obtained. There is an absence of glare, as with the refractor the virtual illuminant is increased to the size of the refractor. The posts are provided with brackets for 60-watt gas-filled lamps and refractor lanterns, for use after 12 p.m. Fig. 2 illustrates the lantern refractor complete, and fig. 3 shows the refractor in section, indicating the application of the Holophane principle. The horizontal illumination recorded at the road surface is shown in fig. 5.

The Holophane lanterns are made substantially of cast-iron, enamel-coated, green outside and white inside, and stoved. They are weather-proof, and provided with ample ventilation, and they have no screws, hinges, or working parts exposed to the weather. The refractors are made of transparent glass with prismatic refracting surfaces designed on the lens principle, allowing the light to pass through and directing the illumination in the direction desired. They are in two parts, one fitting inside the other, the two portions being sealed together to make a dust and weather-proof union. The prisms or lenses being on the inside close together, and the outside and inside surfaces of the complete refractor being perfectly smooth, the lanterns can be cleaned easily. The refractors are very stout, and can be roughly handled without fear of breakage. When fitted on the lanterns they can be easily opened for replacement of lamps or for cleaning purposes. Holophane refractors have been in use for some time in connection with railway, dock, harbour, and other Government lighting schemes. The large saving effected by the use of these lanterns in place of arc lamps, the avoidance of glare, and the uniformity of illumination make them particularly suitable for street and other outside lighting. They are of British design and manufacture throughout, the makers being MESSRS. HOLOPHANE, LTD., of Westminster, S.W.

New "Tricity" Oven.

Our illustration, fig. 4, shows the new form of oven made by the BRITISH ELECTRIC TRANSFORMER CO., LTD., Hayes, Middlesex, which, now that labour and materials have been released, the company is placing on the market. The oven, which differs in several points from the original "Tricity" design, was designed and tested some time ago, but due to war conditions it has been in abeyance. The new oven, in which fixed side elements within the oven and solid lagging between the double sides have been adopted, has an internal capacity of 2¼ cu. ft., the loading being: Maximum, 1,350 watts; medium, 750 watts; and low, 375 watts.

FIG. 4.—NEW "TRICITY" OVEN.

Six 250-watt elements are fitted, two on each side at the bottom, and one on each side on the top; the elements are of the gilled type, the resistance wire being wound on mica strip and enclosed in casing. The elements stand out so as to throw heat direct on the food being cooked, and allow for circulation behind. They are all easily replaced. The oven is made of sheet steel, having a cast-iron front and door

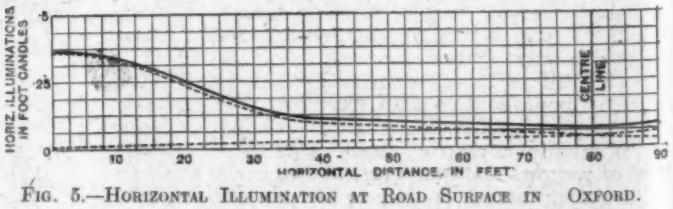

FIG. 5.—HORIZONTAL ILLUMINATION AT ROAD SURFACE IN OXFORD.

frame; the lagging is slag wool, and the unit is complete with a cast-iron control panel consisting of 3-heat switch and "Zed" fuse. While the manufacture of the ovens is proceeding, we understand that the company is in a difficulty with regard to switches, and until a supply of the latter is available the ovens will have to be kept in abeyance. It is a great pity that we should have to depend on supplies from overseas for such an essential item.

THE USE OF HIGH-PRESSURE AND HIGH-TEMPERATURE STEAM IN LARGE POWER STATIONS.

AT Glasgow, on December 10th, Mr. J. H. SHAW's paper (an abstract of which appeared in our issue of July 19th, 1918) was read and discussed before the SCOTTISH CENTRE of the INSTITUTION OF ELECTRICAL ENGINEERS.

Mr. W. J. POOLE said that turbine makers had anticipated the developments now under discussion. As far as boilers were concerned, makers could be relied on to take care of themselves, but when it came to pipe work and accessories it was sincerely to be hoped that history would not repeat itself. The increase in temperature proposed by Mr. Shaw was a very big one. Even now could anyone say that there was such a thing as an inch-valve suitable for, say, high-pressure drains which would behave satisfactorily for any length of time under a pressure of 450 lb., and a temperature which might vary between 100 and 700 deg. F.? He suggested the provision of adjustable tension rods, not across the expansion piece, but all the way between the stop valve and the main header. These tension rods would absorb the thrust, and would at the same time allow the expansion head to fulfil its proper function while maintaining the valve on the superheater and also the header at their relatively correct distance apart.

Staff-Sergeant L. M. JOCKEL thought they might expect some developments for the improvement of the lower limits of temperature and pressure. They required greater knowledge of the metals employed, particularly in flanges and bolts. He had had considerable trouble even with 160 lb. pressure and 200 deg. superheat in this connection, and thought this matter should be more stringently dealt with in specifications. The stress put upon bolts was unfair to anything but bolts of a special design. It would be unwise to jump to very high pressures and temperatures; for near future requirements 250 to 275 lb. per sq. in. and a total temperature of 650 deg. F. was quite sound practice. The line of development in turbines should be towards the two-cylinder type, with separate H.P. and L.P. turbines. It was absolutely necessary to split the turbine into two sections. The L.P. could be used alone in the event of emergencies, and the H.P. portion could be specially constructed to suit high pressure and temperature conditions, while the L.P. cylinder, being of double flow, would offer marked advantages in regard to blade relieving area and diminution of end thrust. The condenser water heads could be designed so that the tubes could be cleaned in sections without shutting down the turbine or the condenser itself.

Mr. R. B. MITCHELL said it would be interesting to know if the series of failures in America of large turbo-alternator sets had anything to do with high pressure or superheat.* The work which had been done at Rugby, and which was soon to be done at the North Tees station of the North-East Coast Supply Co., would no doubt go far to provide accurate data upon which further advances could be made. He agreed that the use of higher pressures would mean the use of steam pipes of smaller diameter. Mr. Shaw's figures for a 20,000-KW. set at 200 lb. and 800 deg. F. gave the steam supply pipe as 14 in. in diameter. This seemed to be on the small side. The 15,000-KW. sets at Dalmarnock station, which would be put into commission this year, would have 16-in. pipes, and the pressure was to be 275 lb. at the boiler with 700 deg. F. temperature. Whilst admitting that the boiler of the future might be one of the flash type with no reserve, it was regrettable that it should be so, as a boiler which held a good body of water was a great asset in a station where sudden peak loads had to be dealt with. He agreed that the old method of arranging for ring mains on steam-pipe systems was bad, and would be difficult to maintain with present-day pressures and temperatures, apart altogether from its inefficiency. With piping designed on the unit principle, the author stated that "a small equalising main need only be provided at the end of the boiler house. The speaker took that to be meant for equalising purposes only. Would it not be well to have this pipe at least equal to the pipe supplying one turbine unit so that the overload capacity of the boiler could be utilised to the fullest extent, and each section of boilers need not necessarily run its own turbine only? The size of the pipe connecting boiler-house sections at Dalmarnock was 16 in., although it was not designed quite on the unit principle, but one section of eight boilers fed into a common receiver from which steam was supplied to two turbine units, and it was these receivers in each section of boiler house which were connected together by a 16-in. pipe. Steam pipes having welded flanges had given, in Glasgow T.C. experience, excellent results at the moderate pressures and temperatures now in use, but there seemed to be a contrary opinion favouring riveted flanges.

Mr. A. PAGE said he had worked out the overall efficiency coal to units on the bus-bars for several of the cases given in the schedules. The highest on 100 per cent. load factor was 22.2 per cent., and last year in the Glasgow area the efficiency of coal to units sold was only 8.6 per cent. There was ample room for improvement here in this direction. Mr. Shaw appeared to put the internal efficiency of the turbine rather high, and the steam consumptions were certainly better than the figures given by manufacturers when quoting. The assumption of constant boiler-house efficiency in making calculations was hardly justified, and it would require a great deal of demonstration to convince engineers in the West of Scotland that a 28-in. vacuum could be maintained using cooling towers on a large scale. He was surprised to find that pipe manufacturers supported the retention of welded pipes and flanges.

Mr. A. E. M'COLL said power houses were at present employing steam pressures much lower than those of Mr. Shaw's figures, and with a lower boiler-room efficiency, they were obtaining overall heat efficiencies slightly higher than those given by the author. While it was not clear that a good case could be made out for a jump to the maximum pressures advocated, there was no doubt that an increase in present practice was justified. Engineers generally were content with a good, instead of the best, vacuum, and condensers, in many cases, were giving better vacua than the turbine could properly deal with. A portion of the increased expenditure which the author advocated might profitably be employed in obtaining lower absolute pressures where the facilities were available, and a better overall heat efficiency would result. This did not apply to stations having cooling towers, and there might be justification here for the employment of the highest pressures.

Mr. J. H. SHAW, in reply, said he saw no reason why steam pipes should not be designed to take care of all the longitudinal stress. It was a wrong policy to do away with economisers and put in air heaters. As to ratio of water to steam, he had got 44, 45, and 46, though he did not think a designer would guarantee those figures. The breaking of bolts was due more to repetition of higher stresses than to high stress. Expansion joints were going to be one of the troubles with high-pressure steam. There was a lot to be said for and against welded flanges.

* See ELEC. REV., April 12th, and October 4th and 25th, 1918.

TESTING FIAT ELECTRICAL ACCESSORIES.

As an example of the painstaking care necessary in electrical work, the methods adopted in the Fiat motor car factory are interesting. This firm decided that all its cars should have both electric lighting and starting, and immediately set to work to build up an important electrical department.

In every branch of the electrical works there is an inspector who controls the quality and workmanship of every article, according to a system common to the whole factory. In addition, there is a special laboratory for purely electrical tests. Thus, in order that there shall be no doubt as to the quality of the insulation, every collector, armature, and winding is passed through a measuring apparatus. The

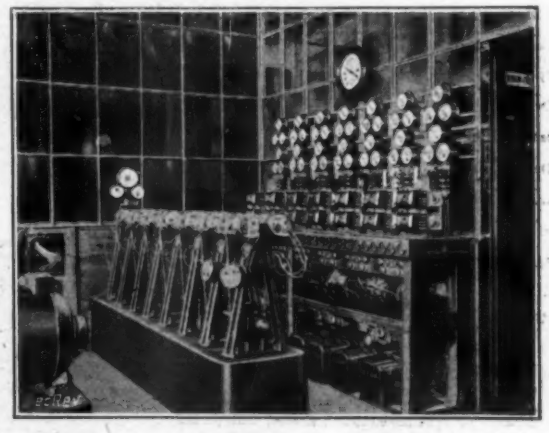

FIG. 1.—FIAT ELECTRIC LIGHTING SETS ON TEST.

windings of the armatures of both dynamos and motors are examined in a special way by means of a magnetic field fed by an alternating current which induces a current in the single spirals. These induced currents show by their intensity whether any defect exists in the armature winding or insulation.

The individual components having successfully passed their tests, the completed motor is mounted on a bench and tested by means of an electromagnetic brake on the Pasqualini patent. During this test the motor is made to run under maximum load. Following this there is a separate test of the engagement and disengagement of the starting pinion with the gears cut on the flywheel. Instead of a petrol motor, there is an electric motor fitted with a flywheel similar to that used on the cars. The starting motor is clamped down to a bench, and the engagement of its pinion

with the electric test motor is noted. The use of an electric instead of a petrol motor for this test enables the resistance to be varied at will and provides complete accuracy of control. After having gone through the load and starting tests each starting motor is sent back for expert examination.

The current regulators, the cut-outs, electric horns, tremblers, all important accessories composed principally of a winding of fine wire with multiple spirals, are examined separately with a view to proper insulation. The two main regulators are enclosed in a metal housing, to which the eleven wires for the lamps, horns, &c., are connected. After being adjusted, each regulator is inserted between a dynamo and a storage battery and practically tested in order to see that it operates correctly under varying engine speeds and various intensities.

The most interesting test is that which includes the dynamo, lamps, and all the electric instruments and the wiring. Sets of 14 dynamos are mounted on a special stand (fig. 1, p. 83), and are driven by their own belts from shafting. Each dynamo supplies current through storage batteries to the full set of lamps used on the car, with the regulators, fuses, ammeter and voltmeter forming a part of the car equipment. In other words, the complete equipment as it will be established on the car is put under test. The dynamos are run at varying speeds, in order to correspond to the actual working on the car, for a period of two hours. During this time the dashboard instruments, which are mounted on a bench opposite the dynamos are subjected to as much vibration as they would undergo with the automobile engine running at full speed. The vibrations are obtained by attaching the instrument board to a shaft with an unbalanced flywheel.

There is a final test which is only possible when the car manufacturer makes his own electrical appliances. The regulator and cut-out are mounted on the front of the dashboard, the ammeter and switch are mounted; all the wires are cut to the right length and the terminals made, so that the dashboards go to the assembly shop with the electrical work fully completed. The assemblers merely have to bolt the dashboard in position and connect the wires to the lamps, the dynamo, and the battery. But before these completed dashboards are sent out of the electrical department they are tested by connecting up the wires to a standard set of lamps, dynamo, and battery, and operating them for a short time. This avoids all possibility of a defective installation finding its way to the assembly shops.

Finally the road testers verify the general working of the electric installations when the chassis are taken out for their general road trials.

NEW PATENTS APPLIED FOR, 1918.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. SKYTON-JONES, O'DELL AND STEPHENS (successors to W. P. Thompson & Co., of London), Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

21,549. "Electrical heating appliances." J. G. LOZANO. December 23rd.
21,559. "Electromagnetic drive for wheels, pulleys, &c." R. N. LENNOX. December 23rd.
21,561. "Telephone exchange systems." C. A. W. HULTMAN. December 23rd.
21,568. "Electric lamps, &c." J. BURRI. December 23rd. (Switzerland, October 8th.)
21,589. "Metallic conduits for electric wiring." F. S. RIPPINGILLE. December 24th.
21,592. "Sparking plug for explosion engines." R. HUREAU & E. RUILLET. December 24th. (France, December 26th, 1917.)
21,610. "Incandescent electric lamps for automobiles, &c." BUTLERS, LTD., AND A. REEVES. December 24th.
21,614. "Cut-out device for use in electrical installations." GENERAL ENGINEERING Co. & A. QUINN. December 24th.
21,628. "Electric welding." J. B. MURRAY & T. E. MURRAY. December 24th.
21,631. "Electric welding." T. E. MURRAY. December 24th. (U.S.A., October 4th, 1917.)
21,633. "Method of electric welding." T. E. MURRAY. December 24th. (U.S.A., February 6th.)
21,634. "Processes of electric welding." J. B. MURRAY. December 24th. (U.S.A., March 22nd.)
21,638. "Group-switching arrangements for automatic or semi-automatic telephone exchanges." C. A. W. HULTMAN. December 24th. (Sweden, December 24th, 1917.)
21,640. "Sparking plug." H. E. BRODERICK. December 24th.
21,643. "Luminous electric switches, bell pushes, &c." S. G. H. LONG. December 24th.
21,644. "Electric switches." L. BENVENUTI & G. CIGOLINI. December 24th.
21,653. "Automatic temperature control for electric irons." S. L. GOLDSBROUGH. December 24th.
21,667. "Wireless telephone transmitters." L. B. TURNER & R. H. WAGNER. December 24th.
21,680. "Magneto-electric machines." A. M. ALLEN & R. B. NORTH. December 24th.
21,681. "Interrupter devices for magneto-electric machines." A. M. ALLEN AND R. B. NORTH. December 24th.
21,698. "Generation of electricity." C. M. WALTER. December 30th.
21,731. "Railway-signalling apparatus." K. CUNNINGHAM. December 30th.
21,769. "Direct-current converters." R. VAN CAUWENBERGHE. December 30th. (France, September 24th, 1917.)
21,776. "Automatic electric water-heaters." G. P. DENNIS & J. LAW. December 30th.
21,779. "Call indicator for telephone systems." AUTOMATIC ELECTRIC Co. AND AUTOMATIC TELEPHONE MANUFACTURING Co. December 30th.
21,781. "Twin sparking plug." J. WILKIE. December 30th.
21,783. "Means for actuating ignition magnetos for starting internal-combustion engines." J. SMITH. December 30th.
21,804. "Sparking plugs for internal-combustion engines." W. STEAD. December 30th.
21,807. "Electrical devices or motors." M. V. O'LEARY. December 30th.
21,811. "Method for transforming kinetic energy in gases into electrical energy, and manner for utilising latter for carrying-out gas reaction." C. PETERSEN. December 30th. (Norway, January 8th.)
21,812. "Electric lamps." F. LEWIS. December 30th.
21,813. "Electric clocks." COVENTRY ELECTRIC CLOCK Co. & T. RUSHTON. December 30th.
21,815. "Lifting magnets." F. N. PICKETT. December 30th.
21,831. "Electric furnaces." E. FENTON. December 30th.
21,862. "Article for preventing crossed wires, rods, &c., vibrating or rubbing on one another." S. W. PEMBERTON. December 31st.
21,863. "Electric furnaces." E. WARING & W. WARING. December 31st.
21,869. "Dynamos." H. LEITNER. December 31st.
21,894. "Electric arc furnaces." U. MAGINI. December 31st. (Italy, December 31st, 1917.)
21,897. "Construction of magneto-electric machines." G. M. TURNER December 31st.
21,913. "Electric switches." E. ABEGG. December 31st.
21,914. "Electric switches." C. E. FOSTER. December 31st.
21,922. "Detection and generation of sound, &c., waves." R. A. FESSENDEN. December 31st. (U.S.A., December 31st, 1917.)
21,930. "Automatic telephone exchange system." W. C. DAVEY & STERLING TELEPHONE & ELECTRIC Co. December 31st.

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43. "Electric accumulators." W. A. T. TWIST. January 2nd.
46. "Electric switches and switch fuses." F. G. WARBURTON. January 2nd.
65. "Submarine telegraph cables." F. G. CREED. January 2nd.
84. "Electrification of seeds and apparatus therefor." J. HEWETT & J. J. H. STURMEY. January 2nd.
139. "Ignition systems." DAYTON ENGINEERING LABORATORIES Co. January 2nd. (U.S.A., January 2nd, 1918.)
140. "Ignition systems." DAYTON ENGINEERING LABORATORIES Co. January 2nd. (U.S.A., January 2nd, 1918.)
165. "Electric fuses." SIMPLEX CONDUITS, LTD., & L. M. WATERHOUSE. January 3rd.
200. "Obtaining single-phase alternating electric currents from three-phase and *vice versa*." A. M. TAYLOR. January 3rd.
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219. "Distributor devices for ignition apparatus." REMY ELECTRIC Co. January 3rd. (U.S.A., April 4th, 1917.)
221. "Electrode holders." P. W. FAWCETT & J. WIGHTMAN. January 3rd.
222. "Electric furnaces." P. W. FAWCETT & J. R. HOYLE. January 3rd.
226. "Magnetos." SOC. DES METEURS SALMSON (Systeme Canton-Unne). January 3rd. (France, January 23rd, 1918.)
248. "Electrical resistance." W. GEARY & L. SATCHWELL. January 4th.
253. "Sparking plugs for internal-combustion engines." A. WILKINSON. January 4th.
276. "Electric switch for burglar alarm." G. NISSEN. January 4th.
293. "Electrical heating devices." J. P. ANNACKER & T. H. RYAN. January 4th.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1917.

8,926. METHOD OF AND APPARATUS FOR THE ELECTRICAL TREATMENT OF GASES. L. Bradley. June 21st, 1916. (107,389.)
13,108. APPARATUS FOR HEATING WATER BY ELECTRICITY. J. H. Robinson and W. O. Workman. September 13th, 1917. (121,302.)
13,136. BRUSH GEAR FOR ELECTRIC DYNAMOS AND MOTORS. J. C. Todman, T. L. R. Cooper & A. A. Lyon. September 13th, 1917. (121,304.)
14,654. ELECTRICAL CUT-OUT. W. H. Illingworth. October 10th, 1917. (Cognate application 6,007/18.) (121,305.)
16,244. ELECTRICAL SIGNALLING SYSTEMS. Sterling Telephone & Electric Co., F. G. Bell & W. C. Davey. November 7th, 1917. (121,308.)
16,261. ELECTRIC ACCUMULATORS. H. Leitner & W. H. Exley. November 7th, 1917. (Cognate application 4,529/18.) (121,309.)
16,475. ELECTRICALLY-HEATED CLOTHING OR FABRICS. Igranic Electric Co., A. H. Curtis & S. R. Wright. November 9th, 1917. (121,310.)
16,581. MAXIMUM-DEMAND CONTROLLER AND LOAD-INDICATOR FOR ELECTRIC POWER INSTALLATIONS. C. C. Gow. November 12th, 1917. (121,312.)
18,046. COMMUTATORS FOR DYNAMO-ELECTRIC MACHINES. H. Chitty. December 5th, 1917. (121,320.)
18,172. ENGINE STARTERS. V. Bendix. December 7th, 1917. (121,324.)
18,343. MINERS' ELECTRIC HAND LAMPS. A. H. Railing & A. E. Angold. December 11th, 1917. (121,337.)
18,438. MULTIPLE ELECTRIC SWITCHES. V. E. Joyce & Park Royal Engineering Works. December 12th, 1917. (121,345.)
18,442. ELECTRIC TRANSFORMERS. British Thomson-Houston Co. & F. W. Cooke. December 12th, 1917. (121,346.)
18,497. ENGINE STARTERS. F. B. Dehn (Eclipse Machine Co.). December 13th, 1917. (121,349.)
18,683. ELECTRIC CABLE GRIPS. W. T. Henley's Telegraph Works Co., W. H. Nichols & E. Moore. December 15th, 1917. (121,358.)
18,963. MAGNETOS AND LIKE DYNAMO-ELECTRIC MACHINES. J. F. Poynter. December 21st, 1917. (121,364.)

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945. METHOD OF AND APPARATUS FOR MANUFACTURING LEAD LININGS FOR ACCUMULATOR BOXES, CISTERN BOXES, AND THE LIKE. W. G. Claughton and J. W. Claughton. January 17th, 1918. (121,383.)
1,032. ELECTRIC RELAYS. Automatic Telephone Manufacturing Co. & P. T. Bates. January 18th, 1918. (121,385.)
2,572. COOLING OF ALTERNATING-CURRENT MOTORS. W. F. Higgs. February 13th, 1918. (121,399.)
3,883. MECHANISM FOR REGULATING THE ELECTRODES OF ELECTRIC FURNACES. V. F. Turner & J. Walker. March 6th, 1918. (121,409.)
6,257. ELECTRIC WELDING AND RIVETING APPARATUS. Thomas Spot Welder Co. October 8th, 1917. (120,028.)
7,724. MACHINES FOR SLOTTING COMMUTATORS AND OTHER ARTICLES. F. E. Aurand. May 11th, 1917. (115,849.)
8,574. ELECTRIC MOTOR CONTROL. British Thomson-Houston Co. (General Electric Co., U.S.A.) May 23rd. 1918. (121,427.)
10,201. MULTIPLE-FILAMENT ELECTRIC INCANDESCENT LAMPS. British Thomson-Houston Co. (General Electric Co., U.S.A.) June 20th, 1918. (121,432.)
10,462. SYSTEM OF ELECTRICALLY-INDICATING ON BOARD SHIP THE DEPTH OF SEA WATER. Y. Kawakita. June 25th, 1918. (121,434.)
10,654. ELECTROMAGNETS. M. H. Goldstone. June 28th, 1918. (121,435.)
14,943. METHOD OF ELECTRICAL TREATMENT OF GASES. L. Bradley. June 21st, 1916. (Divided application on 8,926/17.) (119,236.)
14,944. APPARATUS FOR THE ELECTRICAL TREATMENT OF GASES. L. Bradley. June 21st, 1916. (Divided application on 8,926/17.) (119,237.)
14,947. METHOD OF AND APPARATUS FOR THE ELECTRICAL TREATMENT OF GASES. L. Bradley. June 21st, 1916. (Divided application on 8,926/17.) (119,238.)